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# GENITOURINARY DISEASES
# AND SYPHILIS

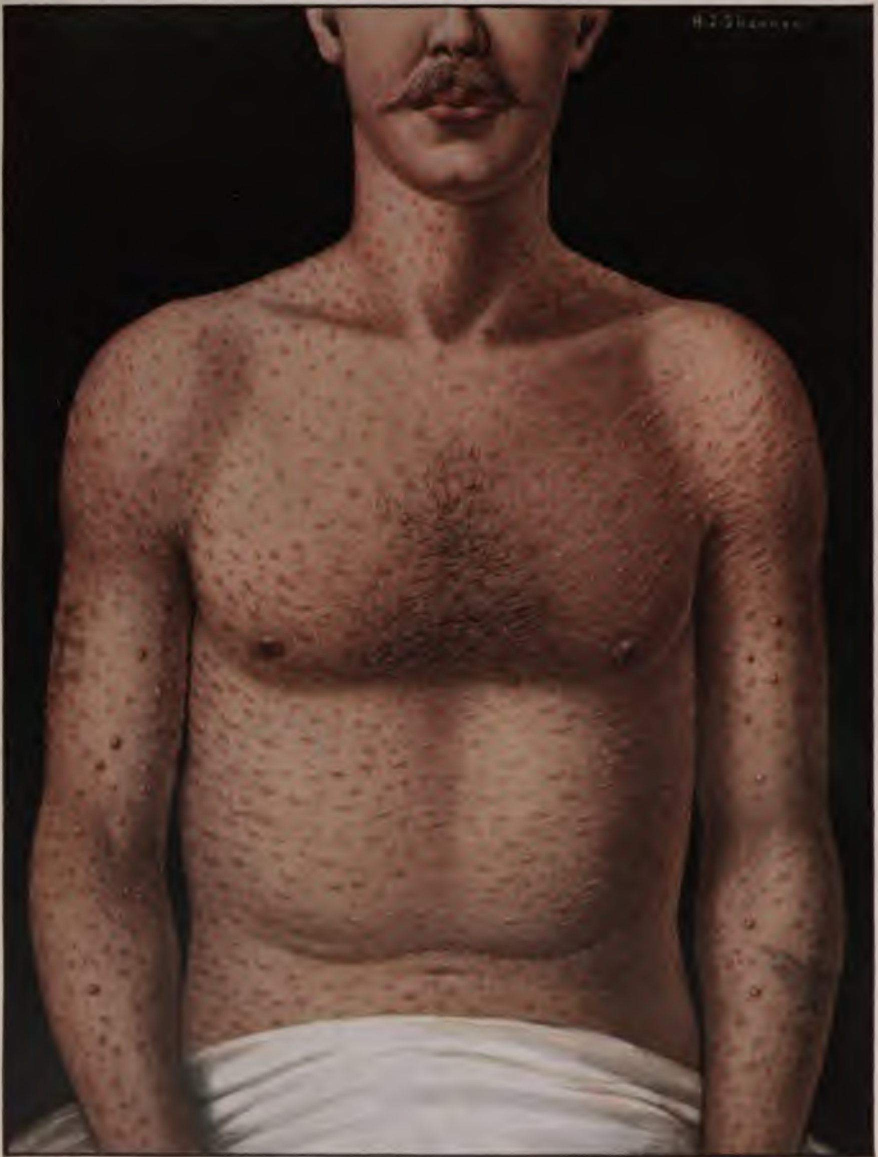

Plate I.

Secondary syphilis. Maculopapular syphilide. (Author's case, Long Island College Hospital.)

# GENITOURINARY DISEASES AND SYPHILIS

BY

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1918

TO THE MEMORY

OF

MY OLD TEACHER AND FRIEND

DR. ALEXANDER J. C. SKENE

IN RECOGNITION OF HIS BRILLIANT ABILITIES AS A SURGEON
AND IN AFFECTIONATE REMEMBRANCE OF HIS
PERSONAL QUALITIES AS A MAN

THIS WORK IS DEDICATED

53726

# PREFACE TO THE FOURTH EDITION

THE gratifying reception which former editions of this book have received at the hands of the profession has encouraged the author to rewrite the entire work and bring it up to date.

In the face of the appalling calamity which has befallen the whole world, the peaceful paths of science have been perforce forsaken, and but few new discoveries or methods of value have been added to the armamentarium of the urologist, but certain plans of procedure have been perfected and made more available.

Among these may be mentioned the application of the high frequency current to the treatment of benign tumors of the bladder, and the use of radium in carcinoma of the bladder and prostate.

A clearer understanding of the importance of preliminary treatment before operating in cases of hypertrophied prostate, and a better knowledge of the details of the after-treatment of the operation have still further reduced the mortality of prostatectomy.

The field of the diagnostic value of the x-rays has been extended through pyelography and their application to the study of visceral and nervous syphilis. Our knowledge of syphilis has been increased by a number of workers in this department; and the detection of spirochetæ in the brains of paretics, the study of the spinal fluid in nervous syphilis and a reconsideration of the views in regard to hereditary syphilis, are all important landmarks of progress; while the intensive method of using salvarsan and mercury and the direct medication of the spinal canal by injections of salvarsanized serum are of the highest therapeutic importance.

The writer wishes to express his thanks to his friends Dr. Albert M. Judd for the chapter on Gonorrhea in Women, to Dr. Alfred Potter for the chapter on the Wassermann Reaction, and to his associate Dr. John H. Burke for the section on the Bacteriology of the Gonococcus, and for his assistance in reading the proofs.

HENRY H. MORTON.

Brooklyn, New York.

# PREFACE TO FIRST EDITION

IN the past ten years no branch of surgery or medicine h
made greater progress than the department of genitourinary su
gery. In that short period of time, the treatment of acute a
chronic gonorrhea has been removed from mere empiricism a
placed upon a scientific and rational basis. This has been acco
plished through investigations, whose results have given us a d
inite knowledge of the microorganisms concerned, and the path
logical changes in the urethral tissues which their presence excit
The whole subject of chronic seminal vesiculitis, with its re
tion to sexual neurasthenia, and the ever-present danger of lurki
infection, has been clearly demonstrated. It is less than ten yea
since the cystoscope came to be of practical use, and out of its
velopment grew the various instruments for collecting the uri
from each kidney separately, in this way stimulating a greater
terest in the subject of renal surgery.

While the operations for stone in the bladder are as old as c
ilization itself, the improvements in the technic of lithotomy, a
a clearer comprehension of the indications for each form of ope
tion, are matters of very recent growth. Ten years ago the ca
of hypertrophied prostate in old men were without remedy, af
the failure of the catheter to alleviate the urgent symptoms, b
today the operations of prostatectomy, castration, and Bottin
operation have opened a way of relieving the suffering and prolo
ing life.

The above-mentioned advances are only a few of the steps in t
progress of this important branch of surgery.

In this volume the author has endeavored to present, in a c
cise form, the present *status* of genitourinary diseases and syphi
At the same time he has endeavored to keep in mind the needs
the practitioner, whose opportunities for seeing such cases may
infrequent, and to consider the questions of diagnosis, progno
and treatment in such a way that the book may be of practical
in these matters.

H. H. M

Brooklyn, New York, 1902.

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# GENITOURINARY DISEASES AND SYPHILIS

## CHAPTER I

## TURBID URINE

Turbidity of the urine is very often overlooked by both patient and physician in serious conditions, unless the patient's attention is called to his bladder by symptoms of frequent urination or pain. When a symptomless turbidity of the urine is noticed by the patient, it is usually by a neurasthenic hypochondriac, and the turbidity is often due to undissolved phosphates and is of no moment whatever.

By mere inspection of the urine, turbidity from different causes looks alike, and it is impossible to distinguish pus, blood, bacteria or salts by the naked eye.

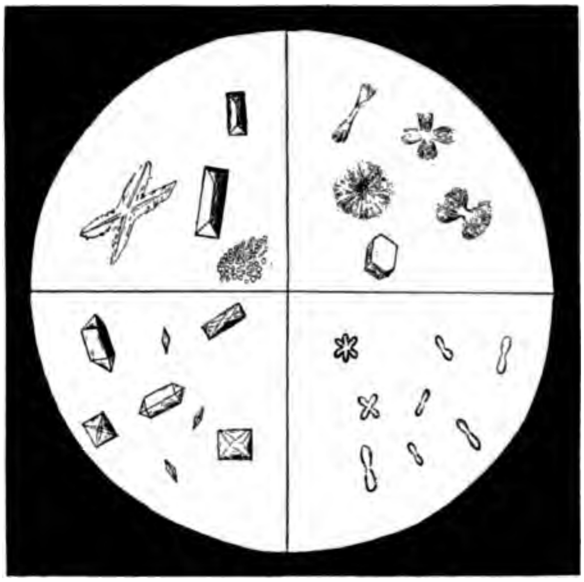
There are certain simple differential tests in common use. Turbidity due to urates clears up on boiling. If the cloudiness is caused by phosphates, a drop of acid dissolves them. If the glass contains pus, a few drops of caustic potash may be added to the urine and when the glass is given a twirling motion the pus becomes agglutinated into a long, ropy mass. Neither boiling, acid nor potash changes turbidity due to bacteria which remains uninfluenced.

The only exact method of differentiation is by means of a microscopic examination of the centrifuged sediment. With the microscope we can see pus corpuscles, blood cells, crystals or bacteria.

The source of pus may be from any point along the genitourinary tract, and only by systematic examination is it possible to determine the source whence it originates.

Pus may originate from:

1. Balanopreputial sac.
2. Urethra:
    - Anterior.
    - Posterior.
3. Bladder.
4. Kidney—right or left.
5. In women, the vagina.



Cut in

Fig. 1.—Upper left—carbonates. Upper right—Oxalates. Lower left—uric acid. I right—amorphous and ammonio-magnesium phosphates.

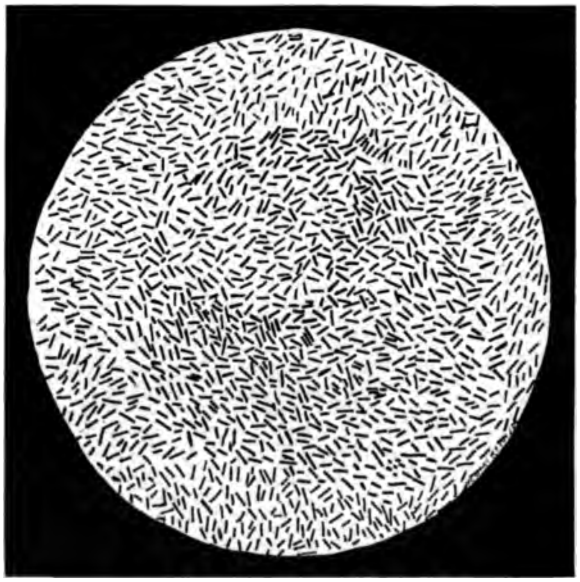


Fig. 2.—Bacteriuria from colon bacilli.

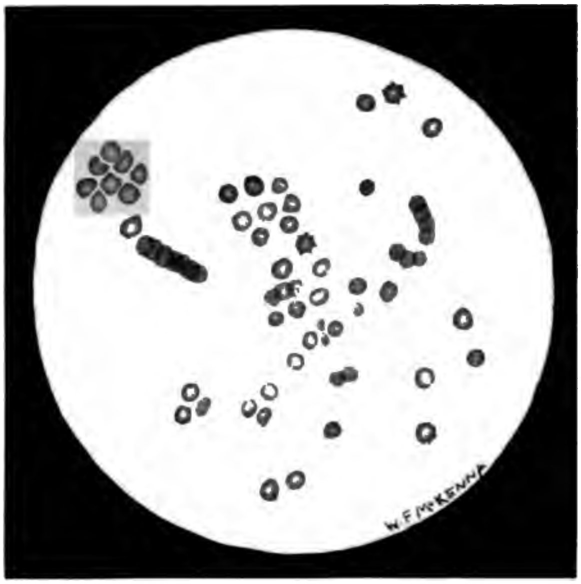


Fig. 3.—Hematuria sediment.

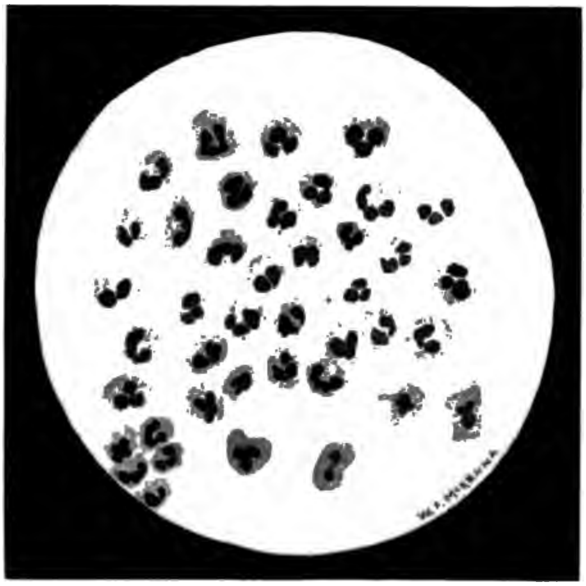


Fig. 4.—Pyuria.

## DIFFERENTIATE BY EXAMINATION

**Inspection and Smears.**—The prepuce should be stripped back t determine the presence of a balanoposthitis or venereal ulcer unde the foreskin, and the urethra milked to cause a drop of pus to issu from the meatus. Smears of the urethral discharge should be take on a cover-glass and examined microscopically for the presence o gonococci.

**Two-Glass Urine Test.**—The patient is requested to pass hi urine in two glasses and retain a little in the bladder. If the firs glass is cloudy and the second glass clear, it denotes that the urethriti is confined to the anterior urethra and the posterior urethra is u affected. If both glasses are cloudy, it indicates that the posteri urethra is affected, as well as the anterior urethra and that the p has made its way back from the posterior urethra into the bladde contaminating and rendering the urine which is contained in t bladder turbid.

**Palpate Prostate and Seminal Vesicles.**—The next step in t examination consists in the palpation of the prostate and semin vesicles through the rectum. After palpation of the prostate a seminal vesicles the patient is requested to pass the remainder of t urine which has been retained in the bladder, and this is known the expression urine. As the expression urine passes through t posterior urethra, it washes out the secretions which have been e pressed by the examining finger from the prostate and seminal v icles, and these appear in the expression urine as turbid flakes comma-shaped hooks known as Fürbringer's hooks or as a m cloudiness of the urine.

## EXAMINATION OF URETHRA

The urethra should then be explored with a bulbous bougie endoscope. The proper instrument for determining the presence stricture is a flexible bulbous bougie, and not a steel sound. T steel sound is only useful for the purpose of detecting heavy ba of stricture which almost completely close the urethra and arr the passage of a sound. The diagnosis of many a stricture has fai by depending on a sound to locate it. With a flexible bulbous bou which is a very sensitive instrument, the presence of wide strictu of the thickness of a fiddle string, can readily be diagnosed.

In the hands of an expert the endoscope is a useful instrum For disclosing infiltration, hard or soft erosions, and the presence Morgagni's crypts in the anterior urethra and in the posterior

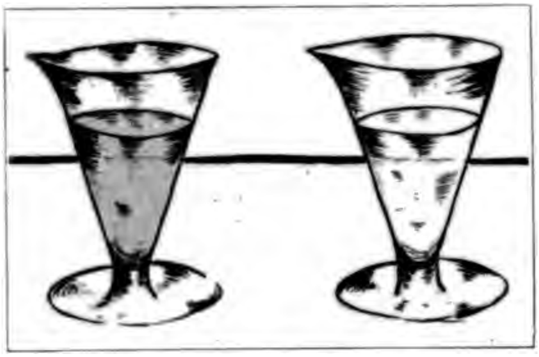


Fig. 5.—Two-glass urine test. *A*. Turbid. *B*. Clear. Anterior urethritis present. Posterior urethra not involved.

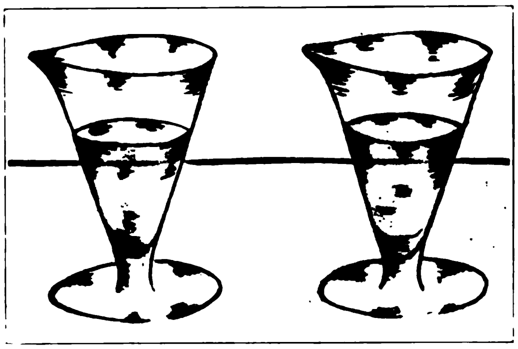


Fig. 6.—Two-glass urine test. *A*. Turbid. *B*. Turbid. Anterior and posterior urethra involved.

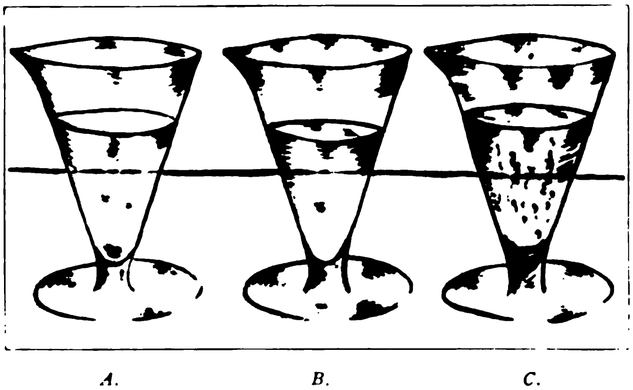


Fig. 7.—Two-glass urine test. *A*. Clear. *B*. Clear. *C*. Turbid with shreds after massage. Anterior and posterior urethra free from suppuration, but prostate and vesicles affected. Expression urine is turbid with shreds.

thra, a state of congestion or disease of the colliculus, the endoscop is an instrument which is indispensable, but the inexperienced ey fails to note the slight changes which may be observed at the end o the tube, and the presence of infiltrations can better be ascertaine with the bulbous bougie.

## PHYSICAL EXAMINATION

### Palpation

**Prostate.**—The size, consistency, and shape of the prostate ca be determined by rectal touch, but in many cases of gonorrheal i flammation the most experienced finger fails to mark any decide change, and it is only by microscopic examination of the expressed s cretion as it issues from the meatus, or as it is obtained in tl expression urine, that the presence of a chronic gonorrheal inflar mation can be determined.

A marked tuberculosis of the prostate is usually denoted by a increase in size and density and a nodular feeling of the prosta or a feeling of small nodules scattered throughout the substance the prostate.

Calculus imbedded in the prostate is a rare condition, but do exist. When present, it gives rise to a feeling of extreme densi and also a feeling of fixation of the prostate.

Senile hypertrophy of the prostate is usually not difficult to fe The prostate bulges into the rectum; it has a moderately soft a elastic feeling; and the upper margin may be within the reach the examining finger, or it may extend so far up as to be out of rea

A suspicion of carcinoma of the prostate should at once aroused by feeling in an elderly man, a prostate with an extre degree of hardness in one or both lobes, and one's suspicion should further aroused by a feeling of fixation of the prostate in the pel As an aid in diagnosis Geraghty's sign may be made use of. W a sound in the urethra, the prostate is palpated through the rectu If the sound can be distinctly felt through the posterior lobe of prostate and the enlargement is chiefly in the lateral lobes, a diagn of simple hypertrophy may be made, but as carcinoma usually atta the posterior lobe first and causes it to become thickened, if on p pating the sound through the rectum the posterior lobe is so mu thickened that the prostate can not be felt, a strong suspicion carcinoma should be aroused.

**Seminal Vesicles.**—Inflammations within the seminal vesicles in the surrounding cellular tissue may be due to infection with gonococcus or other organisms, or to tuberculosis, and differential is not possible by palpation, although a suspicion of tuberculosis should be aroused by feeling an extreme hardness accompanied by a simple nodular condition in and around the vesicles.

To confirm a diagnosis of gonorrheal or simple vesiculitis the vesicles should be palpated and the secretion expressed from them examined with a microscope. This will show the characteristic findings—pus cells, mucus, microorganisms perhaps, and spermatozoa, either absent or dead. As the case goes on to recovery the pus cells disappear and the spermatozoa return.

Examination of the seminal vesicles has a very important bearing at the present time on the question of focal infections and gonorrheal rheumatism. We know today that many cases of chronic arthritis and neurasthenia are due to a focus of suppuration somewhere in the body. The teeth have received the first attention and pyorrhea alveolaris has been demonstrated to be the causative factor in many of these conditions, but the seminal vesicles also play an important role in focal infections, and where other causes have not been found, they should be investigated.

**Bladder.**—Palpation of the bladder may disclose an organ which contains a quart or more of urine, and the bladder may extend nearly to the umbilicus. Such a bladder should never be emptied at one sitting. The sudden drawing off of the urine in the case of a chronically distended bladder relieves the back pressure from the kidneys too quickly and the balance of the kidneys, already disturbed, is destroyed, suppression of urine follows, and not infrequently the patient, if he is an old man, is dead within a week following the misdirected use of the catheter. Such a bladder should be emptied gradually of its contained urine in order that the kidneys may accustom themselves by degrees to the diminishing back pressure, and it is only with extreme caution that an old man with an hypertrophied prostate and a distended bladder can be tided over the critical period of a beginning catheter life.

In cases of hypertrophied prostate with only moderate distention, the residual urine should be measured and its quantity noted. Residual urine is the term applied to the urine which remains in the bladder after the patient has endeavored to completely evacuate the bladder. It is an indication, in a way, of the degree of obstruction to the free and complete emptying of the bladder.

### Thompson's Searcher for Stone

In the presence of suspected calculus Thompson's searcher for stone is an instrument which, though superseded by the cystoscope, still has a field of usefulness. Although stones may be overlook by an inexperienced hand with this instrument, it is very often use in disclosing the presence of calculi, and in former days before cystoscope, those who were expert in the use of this instrument w able to elicit information which was truly astounding. The si number and consistency of stones were made out in the hands of expert, for in the days when we had but few instruments to w with the masters of their profession became extremely proficient the use of the few instruments which they had at their disposal.

### Bimanual Palpation

A certain amount of information may be obtained by placing finger in the rectum or vagina and the other over the bladder regi A thickening of the bladder due to carcinoma can be apprehenc or even a vesical calculus, if it is very large, may be felt. Do A. M. Judd, of this city, has become very skillful in palpating lower segment of the ureters in women through the vagina, anc calculus of the ureter is frequently located in the lower inch, may be a valuable diagnostic aid in cases of this class.

Up to this point the well-informed general practitioner car without assistance, but when he has completed the various step ready described and the source of the pus in the urine still rem in doubt, it is necessary for him to have recourse to the aid of specially trained in the use of instruments—the cystoscopist anc radiographer. In order to be of practical use, the cystoscope be used constantly. It is of no value in the hands of the occas user, for his eye is not trained to see, and what he does see he incorrectly and can not interpret, so to become expert in th of the cystoscope requires constant practice. The same holds of radiographic shadows, for they must be interpreted by one w familiar with plates, who is constantly looking at them and is of the various pitfalls of diagnosis.

### Cystoscopic Examination of the Bladder

With the cystoscope in the bladder the outline of the prosta be distinctly made out if the prostate is enlarged. Tumors seen and a fair idea may be gained as to whether they are mal or benign, and stone in the bladder is particularly easy to fin cases where the bladder has been forced to work against press in the case of a stricture or hypertrophied prostate, the m fibers hypertrophy in bundles and trabeculæ can be distinctl

The same condition takes place in a tabetic bladder where the innervation has been disturbed, and the writer has not infrequently made a diagnosis of locomotor ataxia by means of a cystoscopic examination of the bladder.

After the trabeculæ have lasted for some time the mucous membrane between them gives way and bulges and diverticulæ of greater or less size come into play as a sequence.

To the discovery of the use of the ureter catheter is due our present lowered mortality in kidney surgery. In former times, before we could separate the right and left kidney urines, the mortality of nephrectomy was something like 50 per cent. At the present day, through the ability to separate and examine the right and left kidney urines. the mortality of nephrectomy has been reduced to about 7 per cent.

The urines from the right and left kidneys having been drawn off by the ureter catheter, they must be examined for pus, bacteria, casts, epithelium or blood, and the quantity of urea estimated. In this way an accurate knowledge can be obtained as to whether the kidney is healthy or whether it is infected, how much urea it is capable of secreting, and the organisms which are responsible for the infection. If tuberculosis is suspected and the tubercle bacilli can not be found in the urines, recourse should be had to animal inoculations. The supposed tuberculous urine is injected into the peritoneal cavity of a guinea pig and the pig autopsied three weeks later. If tubercle bacilli were contained in the urine, the peritoneal cavity of the pig will be found studded with tubercular nodules.

## Functional Tests for Separate Kidneys

**Chromocystoscopy with Indigo Carmine.**—The use of indigo carmine applied in this way was first worked out by Völcker and Joseph. It is based on the fact that a normal kidney will secrete indigo carmine in eight minutes after it is injected hypodermatically, whereas any disease on the part of the kidney will delay the excretion of the indigo carmine. It may be applied by catheterizing the ureters and collecting the right and left urines and noting the time of appearance of the blue after injection; or it may be carried out by watching the ureter openings with the cystoscope and noting the time of appearance of the blue swirl in one or both kidneys. The urines should be obtained simultaneously in cases of healthy kidneys and a delay of a number of minutes on one side indicates a diseased condition of that side.

**The Phenolsulphonephthalein Test of Rountree and Geraghty** may also be used in the same way. The indigo carmine, however, is more convenient to use with ureter catheterization.

Where the function of both kidneys together is to be estimated, a permanent catheter is placed in the bladder, left in for two hours and the phenolsulphonephthalein injected hypodermatically. A return of at least 20 per cent in the first hour is necessary for safety in operation. Below 20 per cent of phenolsulphonephthalein indicates disease of the kidney which is liable to bring about anuria and death after an operation.

The presence of sugar following the injection of phloridzin is also a valuable test and not difficult of application; and in very recent times, through the estimation of the patient's blood nitrogen, we have a control for the kidney function tests.

### Radiogram

In many cases, to complete our systematic examination, it is necessary to have recourse to the radiogram to determine the condition of:

1. Kidney and ureters.
2. Bladder.
3. Prostate.

**Kidneys.**—To determine the condition of the kidneys, the points to look for in a radiogram of the kidneys are their outlines, which can only be more or less distinctly seen, and the shadows occurring in their substance. To determine the question as to whether a shadow is a calculus in the ureter or a calcified gland lying outside of the ureter, the leaded ureteral catheter may be introduced and a radiograph taken with the catheter in place. The question of extraureteral or intraureteral shadows is thus readily settled.

To determine if the pelvis of the kidney is largely distended or normal in size, we may have recourse to pyelography. By this manipulation the pelvis of the kidney is filled with a silver salt which throws a dense shadow, a radiogram is then taken and the size of the pelvis of the kidney is denoted by the resulting shadow. When pyelography first came into use collargol was the silver salt which was used. This was found to be toxic in its effects and detrimental to the substance of the kidney and has now been replaced by thorium, which, so far, appears to be free from danger.

**Bladder.**—The application of the radiogram to the bladder consists in determining the presence of diverticulæ. The bladder may be filled with an argyrol solution, a radiograph taken and the bulging diverticulum be clearly seen in shadow.

A radiogram of stone in the bladder is very unsatisfactory. A large stone may appear as a shadow, but not always, and small stones often do not show any shadows at all.

The best instrument for the diagnosis of stone in the bladder is the cystoscope, and with the cystoscope the stone is always beautifully prominent.

**Prostate.**—The use of the radiogram as applied to the prostate may be reserved for the diagnosis of calculus imbedded within the prostatic tissue, and for a differential diagnosis between cancer of the prostate and calculus of the prostate the radiogram is indispensable, for in no other way can a differential diagnosis be established.

# CHAPTER II

## HEMATURIA

In considering the question of hematuria it should be remembered that the day for the treatment of symptoms is past. In former times, before the invention of the cystoscope and the radiogram, when a patient complained of blood in the urine, it was admissible to temporize with rest, ergot and ice bags over the bladder, and in this way the hemorrhage could be controlled for a while, but it always returned. After constant recurrences the underlying condition would finally be disclosed, but too late for curative treatment.

Today, instead of regarding hematuria as a symptom to be treated, it is a far safer attitude to regard it as a warning of some serious condition in the bladder, kidneys or prostate, and a practitioner should never temporize until the diagnosis has been established.

In many branches it is taught that it is against professional morality to treat symptoms with palliatives, and in this connection we may cite the metrorrhagia which occurs in elderly women. By temporizing it may be too late for a hysterectomy to remove the cancerous uterus, when finally the diagnosis of cancer of the uterus is made and the woman's life is sacrificed by the delay. The same holds true of the first attack of blood in the urine. If the practitioner waits for the second or third attack of bleeding before insisting on a diagnosis, the tumor of the bladder may have extended and become inoperable, or the stone in the kidney may have completely destroyed the organ.

If the hematuria was caused by a hypernephroma of the kidney, metastatic deposits in remote organs have occurred, or the cancer of the prostate has burst through the capsule and involved the bladder wall, and the patient's chance of life through operation has been lost.

*Hematuria is a warning calling for prompt investigation of the cause.*

In a case of hematuria the question arises: Does the bleeding come from the bladder, prostate or kidneys? If it be from the kidneys, which one? Or does it come from the urethra?

Examination must be made methodically.

## METHODICAL EXAMINATION

The kidneys should be palpated and the prostate examined per rectum. An enlargement of one kidney which is perceptible to the touch, accompanied by hematuria, points to hypernephroma or renal calculus of long standing with many adhesions and a very thick capsule, and in very exceptional cases to tuberculosis.

If rectal palpation discloses an enlargement of the prostate in elderly men, it implies a senile hypertrophy or carcinoma. In many cases palpation discloses nothing, in which case recourse must be had to other means of investigation.

Thirty years ago Max Nitze, of Berlin, a gifted mechanical genius, invented the cystoscope and this was the beginning of the era of genitourinary surgery, for through this instrument, making accurate diagnosis possible, modern surgery of the bladder and kidneys was evolved.

The next step in the investigation of a case of hematuria consists in an examination of the interior of the bladder with the cystoscope. Cystoscopic examination may disclose a perfectly normal bladder.

On the other hand the most common cause of bleeding from the bladder is probably tumor. Next to that come either tuberculous ulcers of the bladder or stone. A prostate large enough to cause bleeding should have already been discovered by palpation through the rectum. Before the days of the cystoscope stones were often missed with the searcher and tumors and ulcers could not be diagnosed at all.

There is another form of bleeding which might be spoken of here, although rarely seen in this country, and then only when imported. In Egypt and South Africa it is quite common. It is caused by the parasitic worm Schistosoma hematobium, and the disease is known as bilharziasis.

The parasitic worms are developed in the portal veins and when fully grown they make their way to the bladder and lie under the mucous membrane and the eggs pass through the mucous membrane of the bladder and cause small ruptures and bleeding. Cystoscopic examination of the bladder shows brilliant white spots surrounded by patches of perfectly healthy mucous membrane, and microscopic examination of the blood shows the eggs in the escaped blood. In this country, however, it is more of a medical curiosity than of any practical value, although in the Long Island College Hospital, where we have patients from all over the world, we occasionally meet with a case of bilharziasis.

## Bleeding from the Kidneys

In the event of finding a normal bladder with the cystoscope, one should suspect the kidneys as the source of the hemorrhage and the renal condition which causes hematuria most frequently is renal calculus. Another not infrequent cause of bleeding is hypernephroma.

Varicose conditions of the blood vessels in the pelvis of the kidney with erosions is a rare cause, but is sometimes responsible for the hemorrhage.

Tuberculosis of the kidney occasionally gives rise to hemorrhage by the ulceration of nodules in the kidney and opening up of a blood vessel. It is analogous to the hemorrhage from the lungs in pulmonary phthisis.

Traumatism or blows upon the back over the kidney region will, if sufficiently severe, cause a rupture of one or both kidneys with resulting hemorrhage. The lacerations are slow in healing and the hemorrhage lasts for a long time. I have known it to persist for months, showing that the ruptures were still unhealed. In these cases the diagnosis is made strongly probable by the history of injury followed immediately by hematuria.

To establish definitely the character of the lesion in the kidney and also to decide whether the right or left kidney is affected is one of the triumphs of modern surgery. With the cystoscope we can sometimes see the blood issuing from one ureter. One should not rest content with that, but should employ ureteral catheterization, functional kidney tests, and chromocystoscopy. Chromocystoscopy was first employed by Völcker and Joseph and consists in injecting a small quantity of indigo carmine under the skin. In a patient with normal kidneys a blue stream of urine is seen through the cystoscope issuing from each ureter in from eight to ten minutes. In a diseased kidney the excretion of blue is delayed and it may take from twenty minutes to a half-hour or more before the blue makes its appearance on the side which is diseased. The simultaneous excretion of urine means a normal relation between the two kidneys, whereas a delay of excretion on one side indicates the presence of disease on that side.

Instead of using chromocystoscopy we can also catheterize the ureters, collect the urine from each side, and make a chemical examination of the separate urines.

It is our custom in the Long Island College to depend upon the relation of the quantity of urea from the right and left kidneys and the time of appearance of the blue stream after using the indigo carmine test, and we find that these tests are sufficient for all practical purposes.

In some of the other clinics, in Germany particularly, phloridzin and cryoscopy have been used for the purpose of determining the relative functional capacity of the kidneys, but have been largely abandoned at the present time in favor of chromocystoscopy. In the last year or two phenolsulphonephthalein has been used to show the relative functional kidney capacity, and while it is a useful and accurate test, we prefer to limit its use to estimating the function of both kidneys together by withdrawing the urine from the bladder. .

The third step in the diagnosis consists in having a radiogram made of the kidney region, for without the radiogram one can not be sure of the presence or absence of a renal calculus.

For calculus of the bladder cystoscopy is preferable since the stone can be seen with the cystoscope more easily than the shadow can be observed by means of a radiogram.

### Examination of the Urethra

If the methodical examination which has been described fails to locate the source of the hemorrhage, the urethra, especially the posterior urethra, should be examined with the urethroscope. In chronic posterior urethritis arising as a result of onanism or sexual excesses, the posterior urethra is always congested and bleeds freely. Also in elderly men who have a beginning enlargement of the prostate, pressure on the plexus of veins causes a leakage of blood into the posterior urethra. Occasionally calculi impacted in the urethra causing interference with the flow of urine and, very rarely, polypi in the anterior or posterior urethra may be the source of the hemorrhage, and in women a urethral caruncle sometimes causes a little bleeding.

## TREATMENT OF HEMORRHAGE FROM THE BLADDER DURING THE ATTACK

Sometimes the hemorrhage is profuse but never dangerous to life, except that, by long continuance, it kills the patient by general debility and weakening. Rest in bed and an ice bag over the suprapubic region will generally cause the hemorrhage to stop. Internally, hydrastis, ergot, stypticin or calcium chloride may be of assistance.

Hypodermic injections of horse serum is a remedy which is largely used in modern times, and the author has seen cases of persistent hemorrhage checked by increasing the coagulability of the patient's blood by feeding him with large quantities of calves'-foot jelly for several days.

Locally, a permanent catheter should be introduced and tied in the urethra. This stops the muscular contractions and puts tl bladder at rest. The bladder should be washed once a day wi nitrate of silver, 1:1000. Three ounces is a sufficient quantity to u at a time.

It is important not to distend the bladder as its distention caus the clots to loosen and fall out of the mouths of the vessels. I using three ounces of fluid the clots are not disturbed and an esch is formed over the bleeding points.

Hemorrhage may be controlled by the method of L. B. Ban which consists in the injection of two ounces of creolin solution the strength of ¼ to ½ per cent, retaining it in the bladder for fr twenty to thirty minutes. Injections should be made daily at fi and later every second day. Bangs reports several cases of inopera cancer of the bladder in which hemorrhage was controlled by creo injections.

Merck's solution of gelatin, 2 per cent, injected into the blad and retained there, has also been found useful.

## Evacuation of Clots

The clots usually soften and pass naturally without artifi interference, but if the bladder is greatly distended by clots and u they may be broken up and washed out by injecting one to two dr of peroxide of hydrogen through a large catheter into the blad The peroxide of hydrogen disintegrates the clots and they may t be washed out with salt solution. This is a practical point which called to my attention by Dr. C. S. Cochrane and I have use successfully in several instances.

Another method of getting rid of the clots in the bladder i means of the litholapaxy tube and aspiration. The clots ma broken up and drawn off by this method, but it is rather hazar to use on account of the danger of causing the bleeding to start af

If the bleeding is uncontrollable a suprapubic cystotomy sh not be too long delayed, for by this means we can turn out the inspect with the eye the actual condition which is giving ri the bleeding in the bladder and deal with it as may be indicat the time.

# CHAPTER III

## TESTS OF KIDNEY FUNCTION

A knowledge of the secreting capacity of the kidneys today is an essential preliminary before any operation is undertaken on the genitourinary tract.

Most of the postoperative deaths in urologic surgery occur as a result of suppression of urine. In cases of long-standing obstruction to the outflow of urine occasioned by stricture, stone or hypertrophied prostate with retention of urine, the back pressure on the ureters and kidneys sets up a nephritis and pyelitis, or at least a condition where the balance of circulation in the kidneys is easily disturbed. Any operation is liable to throw the damaged kidneys into a state of acute congestion and the patient dies in from four to seven days from suppression of urine. The functional kidney tests enable us to avoid these untoward deaths after operation and institute the correct preliminary treatment. For this reason before operation it is essential that we know the working capacity of the kidneys and if they are not sufficiently active to support life it is imperative that treatment be instituted to improve their function, and in the event of not being able to succeed in bringing about an improvement of function, to refuse surgical interference which will only serve to shorten the few weeks on earth remaining to the unfortunate sufferer.

The above remarks apply particularly to the measure of function of both kidneys together, but the tests are equally important in unilateral surgical diseases of the kidneys.

In modern kidney surgery the operative mortality ranges about 9 per cent, whereas twenty years ago the mortality after kidney operations was from 36 to 52 per cent. What has brought about the change in the operative mortality? This great reduction in the death rate is due to our ability to catheterize the ureters and to know positively whether the disease is located in the right or the left kidney, and at the same time to ascertain the condition of the other kidney. It is not enough to know which kidney is diseased. We must also know what the condition of the other kidney is. If we locate the disease in the right kidney, we must know that the left kidney is healthy and capable of supporting life; and if it is, we can operate safely. The functional kidney tests are applied in these cases.

With these few remarks we will now proceed to review the various methods of testing the secreting power of the kidneys.

Let us take up first the methods of measuring the function of both kidneys at once, as in the case of hypertrophied prostate or stone in the bladder.

## PHENOLSULPHONEPHTHALEIN

Modern urology is under a great debt to Geraghty and Rountree for discovering and applying this simple and accurate test of the functional activity of the kidneys. This test is based upon the fact that phenolsulphonephthalein (prepared by Hynson, Westcott and Dunning, of Baltimore, Maryland) is eliminated rapidly by the kidneys without injury to them and gives a bright red color to the urine when an alkali is added. The percentage of drug elimination is readily estimated by comparison with a standard solution of known strength by means of the Duboscq or other colorimeter.

The test is made by emptying the patient's bladder completely and 1 c.c. of the standard solution of the drug injected into the muscles of the back.

At the end of one hour the entire contents of the bladder should be carefully collected, and the amount of the drug secreted accurately estimated by a colorimeter. Again, at the end of the second hour, another such collection and similar examination should be made.

As to the value of the phenolsulphonephthalein test the author quotes at length from Dr. Geraghty's article:

"The phthalein test has given valuable information in all these cases and has enabled us to differentiate those cases with severe renal damage from those in which the renal involvement is slight. As a rule the test has demonstrated the greatest impairment of function in those cases which have large residual urine and have not been leading a catheter life. Clinically, this type of case is recognized as the most dangerous when operation is undertaken without preliminary treatment. In many instances in which the output of the drug was low when the patient was first seen, the adequate *régime* described above has resulted in a decided improvement of the kidney function as indicated by the test.

"When the time of appearance is delayed beyond twenty-five minutes and the output of the drug is below 20 per cent for the first hour, operation is postponed regardless of the patient's clinical condition. If under routine treatment the output remains low but constant, the renal function is probably in a stable condition, and the operation may be undertaken, care being taken to select an anesthetic which will not further depress the renal function. In one instance a successful operation was performed with an output of 8 per cent for the first hour, but this output had remained constant for a period of five weeks. The low output here was ascribed to chronic interstitial changes in the kidney, and nitrous oxide was accordingly employed.

"When the residual urine is large and the patient has not been leading a catheter life, even if the output at a single determination is large, operation is deferred in order to determine whether the functional activity is stable, for it has long been recognized that following the relief of retention the function of the kidney is extremely variable. Repeated determinations should be made, and, except when unavoidable, operations should not be performed when the tests indicate a decreasing function. There have been two such cases in our series, in both of which operation was followed by death from acute suppression. Again when only a trace of dye is excreted, operation should not be attempted, as grave renal changes exist. Two cases excreting only a trace died of uremia within a short period. In neither case was any operation performed, though clinically at the time of the first test no evidence of uremia was detected."

The introduction of the phthalein test has been a great factor in lowering the mortality rate in prostatectomy, and no operation should be undertaken in prostatic cases without first having acquainted ourselves with the functional condition of the kidneys, by this or some other means.

The phthalein test also is often applied to the differential tests between the right and left kidneys, but for this purpose the author prefers indigo carmine.

## PHLORIDZIN

The phloridzin test is based on the fact that phloridzin causes an activity of the kidney-cells which enables them to withdraw sugar from the blood, and on examining the urine we find glucose.

When the secreting power is at its highest a large amount of sugar will be produced, and when the secreting power is impaired less sugar will be eliminated.

A solution of phloridzin, Merck, 1:400, is injected in 30-minim doses hypodermatically into the gluteal region. The elimination of sugar begins from fifteen to thirty minutes later. The patient is then catheterized and the urine is examined. Healthy kidneys will generally produce about 1 per cent of sugar and over, while in defective kidneys the quantity of sugar eliminated amounts to a small fraction of 1 per cent, and in the greatest disturbances of renal function no elimination of sugar can be accomplished.

A delay in the time of excretion also points to disease of the kidneys. Dr. Robert H. Greene has experimented extensively with thi test and calls attention to the fact that a delay of thirty minute in showing sugar in the urine is strongly indicative of disease kidneys and a positive indication of some disturbance of the tissu metamorphosis acting as a strong plea for further investigation o the case.

The above described tests are accurate and reliable and give sufficient data for clinical work so that the complicated and not ver accurate tests of artificial polyuria, methylene blue and cryoscop have been entirely superseded.

## TOTAL NITROGEN AND UREA IN THE BLOOD

This is a recent functional test and is at present being extensivel tried out. It is based upon the fact that in all tests of renal fun tion a marked increase in the blood nitrogen will be found, but uremia is not dependent upon the retention of nitrogen, a knowled of the quantity of nitrogen in the blood, by itself, is of little or prognostic value. Of greater help is the relation between the nitr gen of the blood and the nitrogen excreted by the kidneys, as express by Ambard's coefficient or the McLean index.

The difficulty of applying these tests, particularly to clinical case is that they need an expert chemist to carry them out and after t results are obtained they are not as dependable as the simple clinic tests already described.

## COMPARISON OF THE FUNCTION OF THE RIGHT AND LEFT KIDNEYS

Up to this point we have considered the question of the functio activity of both kidneys taken together, from the secretion of ea mixed in the bladder, but in cases of unilateral disease of the kidn it is necessary to know which kidney is affected, the extent a character of the lesion, and also whether the other kidney is sou and capable of supporting life. For this information the urines m be drawn by ureter catheter from the right and left sides and fu tional kidney tests applied. Indigo carmine is the drug par excelle for this purpose, and the general term "chromocystoscopy" is appl to the method of using it.

The use of indigo carmine, which, after hypodermic injecti is eliminated by normal kidneys in from eight to ten minutes, giv the urine a dark blue color, was first used by Völcker and Jos and is now very generally used in determining diminished eliminat from either kidney.

A tablet of indigo carmine (Brückne, Lampe & Co., Berlin, or Burroughs, Wellcome & Co., London) is dissolved in 10 c.c. of water and injected hypodermatically into the buttock, the patient having abstained from water for four hours previously.

In from five to eight minutes a blue stream of urine is seen issuing from the ureter of the normal kidney, and delay in excretion on the opposite side denotes disease with diminished functional activity.

Catheterization of the ureters is not necessary: all that is needed is to keep the mouth of the ureter in view with the cystoscope and watch for the blue stream to make its appearance in the field of vision, but the author prefers to catheterize the ureters and collect the urines in separate bottles.

From a personal experience of over five years with indigo carmine the author can state that it is always reliable, and a delay of some minutes on one side, with the blue appearing in normal time on the other side, always indicates disease on the side of retardation. Any form of disease in the kidney, such as nephritis, pyelitis, tuberculosis or calculus, will retard the appearance of the indigo carmine on the affected side and the extent of involvement of the kidney parenchyma can be estimated by the length of time of retardation. Indigo carmine has an advantage over phthalein, which can be used as a color test in the same way, in that indigo carmine is a time test and not quantitative, consequently the catheter need only be left in place until the blue appears, while for a correct phthalein reading it is necessary to collect the urine for two hours.

In cases where it is impossible to introduce a catheter into the ureter, by watching the ureteral mouth for the blue jet we can determine whether the excretion of indigo carmine is on time or is retarded.

Indigo carmine also has the advantage of being nontoxic, and it is possible to collect the blue urines in bottles and subject them to a microscopic and chemical examination, and use the remainder to inoculate guinea pigs without influencing any bacteria which may be present in the urine.

As a further control against the indigo carmine test, the relative quantity of urea secreted by each kidney simultaneously is also a valuable index of the health or disease of the kidneys.

## COMPARISON OF UREA SECRETED BY EACH KIDNEY

It has been proved by experiment that healthy kidneys secrete exactly the same amount of urea during and at the same time, and if one kidney is diseased the excretion of that organ is diminished.

A full quantity of urea would thus show a normal kidney, while a marked diminution of urea from the other kidney would show diseas of that organ.

The urea test commends itself because it is accurate and can b easily carried out with a simple testing apparatus.

In former times, before the introduction of indigo carmine an phthalein, in our work in the Long Island College Hospital w depended largely on the relation between the amount of urea on t right and left sides and found it to be generally a very usef clinical guide, and we still make use of it in conjunction with indi carmine.

# CHAPTER IV

## RADIOGRAPHY

The advances in urology in the last thirty years have resulted from the invention of new methods of investigation, and the discovery of the x-ray opened up new and before undreamed-of possibilities.

Today the technic of radiography is so well understood that few mistakes are made provided the work is done by competent men; but, as in every branch of medicine and surgery, amateur roentgenologists without sufficient skill and with imperfect machines bring the subject into disrepute through their unwarranted mistakes.

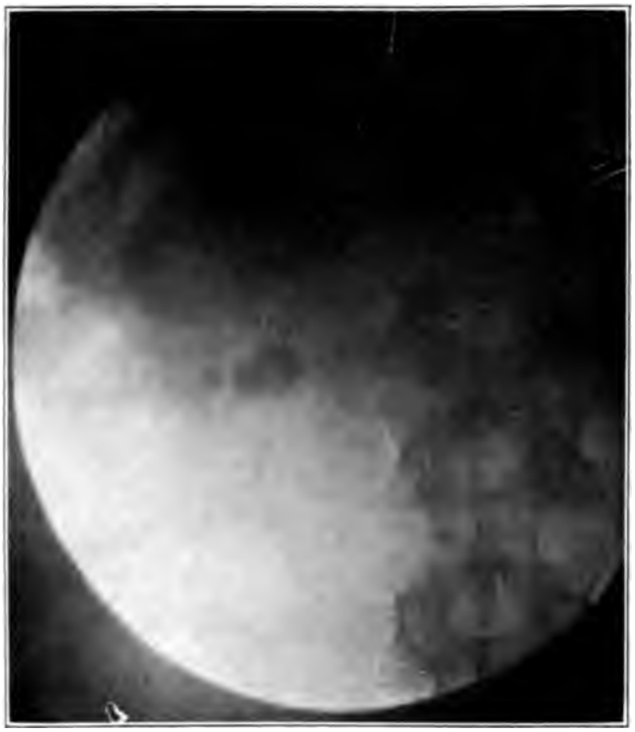


Fig. 8.—Radiogram of calculus in pelvis of kidney. (Author's case, Long Island College Hospital.)

Not only is it necessary to get good plates, but the radiographer must be able to interpret them correctly, for the entire value plate depends upon its correct interpretation.

The difficulty of obtaining good plates varies much with the of the patient. In young and thin patients the plates are showing a large amount of detail, and it is possible to demor in them the presence of any calculus large enough to cause sym

Old subjects are larger, their tissues are not so easily pene by the rays and the plates do not show so much detail. The r

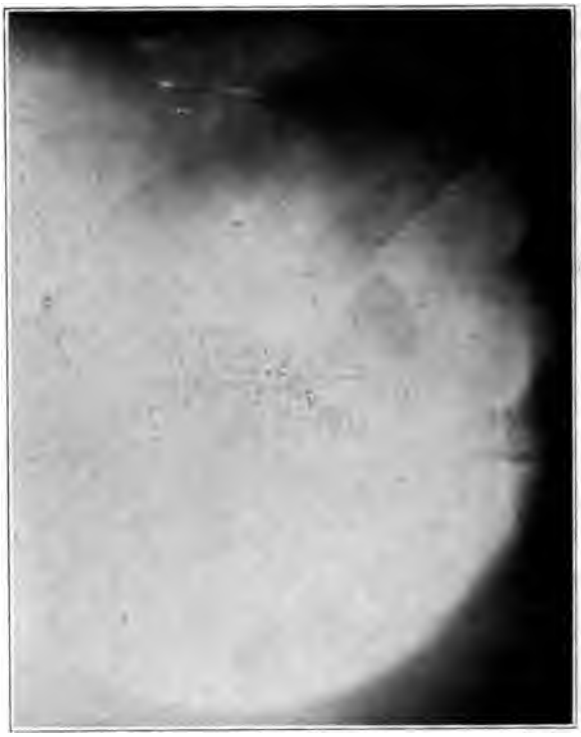


Fig. 9.—Radiogram of calculus in pelvis of kidney. Removed by pyelotomy (Author's case, Long Island College Hospital.)

rapher must be prepared to accept the difficulties and responsil of interpreting an inferior plate. For the kidney region, the which are considered necessary for the plate to show are the t rib to its tip, the transverse processes of the lumbar vertebr the border of the psoas.

The shadows of the kidneys are often shown, especially in su having a considerable amount of perirenal fat, and give use formation as to their size, outline, and position.

Before making a radiogram the intestinal canal must be thoroughly emptied, and for this purpose two ounces of castor oil given at night, followed by high enemata in the morning, is to be preferred to other cathartics, as it leaves less gas in the tract.

The certainty with which a calculus can be shown depends upon the composition and density. Uric acid stones give the faintest shadows, and calcium oxalate, the strongest.

It is necessary, and sometimes it may be difficult, to distinguish between the shadow of a calculus and that of another substance which casts a similar shadow. Among these extraurinary bodies may be mentioned buttons in clothing, undissolved pills or capsules in the intestine, phleboliths, calcified lymph nodes, intestinal concretions, etc. While it is usually easy enough to determine that such shadows are not due to calculi, some of them, especially those in the pelvis, may closely resemble in position and appearance the shadows of small calculi in the lower part of the ureter. Occasionally it may be advisable to pass a styletted ureteral catheter in order to determine whether such bodies are within or without the ureter.

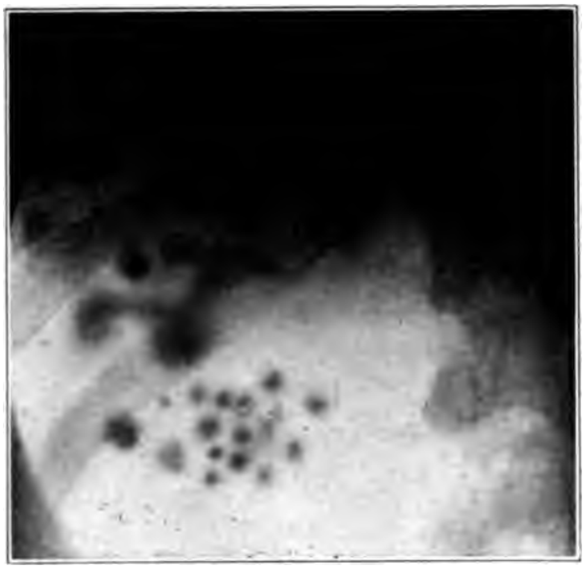


Fig. 10.—Radiogram showing shadows of multiple kidney stones. (Author's case, Long Island College Hospital.)

The present status of the value of the radiogram is well summed up by Doctor E. W. Caldwell.[1]

"1. The roentgen ray furnishes the most accurate single means we have for the diagnosis of urinary calculi in the kidney a ureter.

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[1] Boston Med. and Surg. Jour., Jan. 23, 1908.

"2. It has the advantage over other methods that it not on indicates the presence or absence of calculi, but their size, positio and number as well.

"3. When a small calculus is shown in the ureter, the size a shape of its shadow will sometimes enable us to predict that it w be passed, and that operation for its removal will be unnecessary.

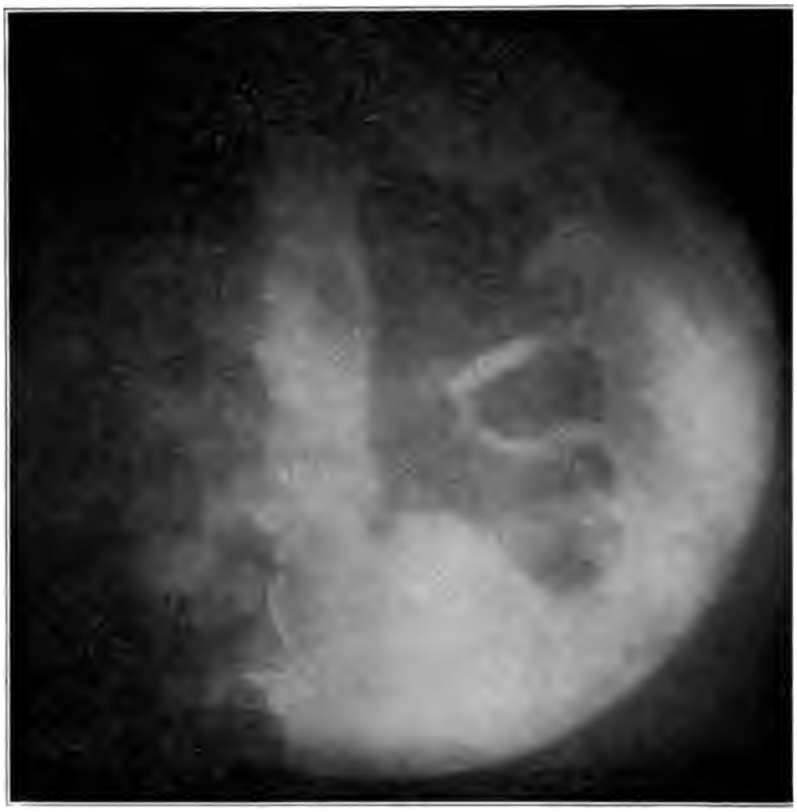

Fig. 11.—Radiogram of calculus filling entire pelvis of right kidney. (Author's case, Lo Island College Hospital.)

"4. Occasionally, conditions other than lithiasis may be indicate such as tuberculosis, abscess, and diseases causing a change in the si position or outline of the kidney, or a fibrous thickening of the low part of the ureter.

"5. The x-ray is not infallible, and in incompetent hands it m be very misleading, but under the best conditions it is exceedingly accurate.

"6. The indications given by it often decide the important question of operation.

"7. Such examinations should therefore not be undertaken lightly, nor intrusted to careless and incompetent persons, nor to those who have not a proper appreciation of the responsibility involved in deciding a question upon which may depend the health or even the life of a fellow-being."

# CHAPTER V

# PYELOGRAPHY

Pyelography was first used by Völcker and Lichtenberg in Czerny's Clinic in 1906 and consisted in filling the pelvis of the kidney with a solution of collargol, which cast a heavy shadow, and then taking radiograms.

The method was subsequently developed by Braasch of the Mayo Clinic, and is now indispensable in many cases where the diagnosis can not be made by the ordinary methods of ureteral catheterization and x-rays.

## METHOD OF EMPLOYMENT

Originally a solution of 5 or 10 per cent of collargol was employed for filling the pelvis of the kidney, but it was found that in certain cases the solution ascended into the tubules and out into the surrounding kidney tissue, carrying infectious material with it, and causing serious inflammatory lesions, infarcts, and necrosis of the kidney parenchyma.

On account of the dangers, collargol has been largely replaced by thorium nitrate which seems to be innocuous.

As the opacity of a substance to the roentgen ray depends upon its atomic weight, thorium was selected as being next to the heaviest known element.

A 10 per cent solution of thorium nitrate can be used, but Burns finds that a solution containing a double citrate of sodium and thorium together is much to be preferred.

The solutions used contain 10 per cent and 15 per cent of thorium nitrate, and are made in the following way: 10 grams of thorium nitrate are dissolved in as little distilled water as possible; to this solution, kept hot on a water or steam bath, are added 30 c.c. of a 50 per cent solution of sodium citrate, the additions being made in small quantities, the solution being shaken thoroughly after each addition. After the addition of the citrate solution a white gummy precipitate is formed which later becomes granular and finally dissolves on the addition of all the citrate solution. This solution is then made neutral to litmus by the careful addition of a normal solution of sodium hydroxid and made up to 100 c.c. with distilled water.

The content in this solution is approximately as follows: thorium nitrate, 15 per cent, sodium nitrate, about 9 per cent, sodium citrate, 21 per cent, the thorium being most probably in the form of a double citrate of sodium and thorium.

Burn's conclusions are as follows:

"1. Clinically there has never been the slightest evidence of toxicity in a series of 125 cases, the amounts used in a single case varying from a few cubic centimeters to almost a liter. This alone is proof of its nontoxicity.

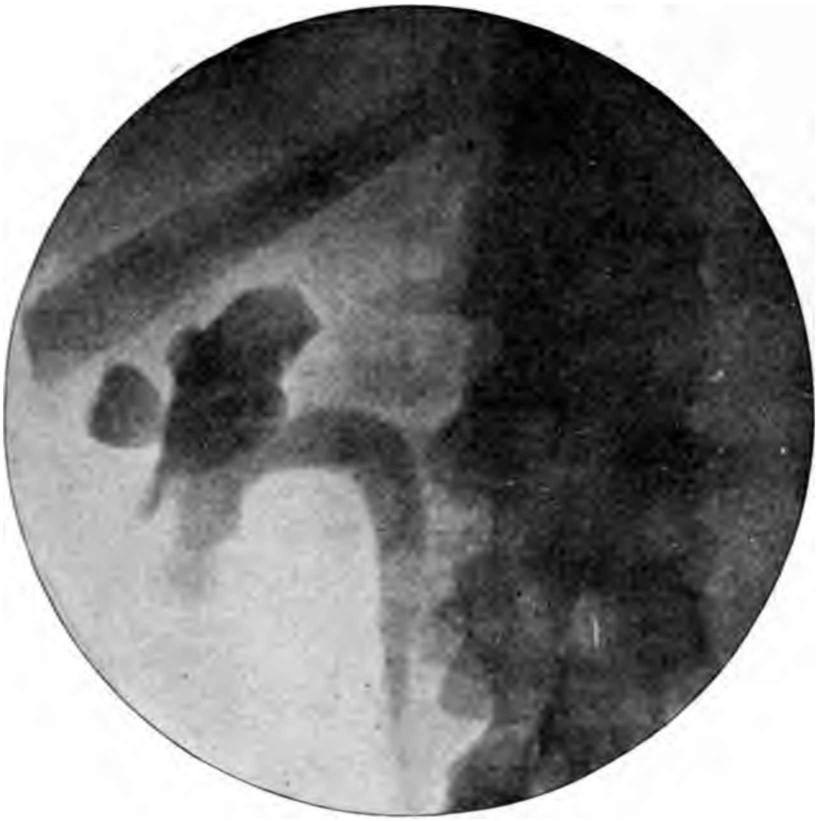

Fig. 12.—Radiogram. Kink in ureter from prolapse of kidney. (Courtesy of Dr. Eastmond.)

"2. There are no urinary symptoms after its use, which tends to show that the solution is nonirritating. There is no evidence of irritation either at cystoscopic examination or at operation.

"3. The pyelograms and cystograms made with this solution show a splendid shadow which possesses an unusual clearness of delineation.

"4. The solution does not stain the linen and as it is perfectly clear and watery it possesses a great degree of fluidity permitting its ready elimination from the urinary tract. Furthermore, its cost is about one-third that of collargol."

After the solution is prepared, it is injected through a ureteral catheter into the pelvis of the kidney and a radiogram is taken immediately.

The best way to introduce the solution is by means of gravity from a burette, allowing the solution to flow gently into the pel of the kidney through a ureteral catheter, and when the pelvis is f the flow ceases. A normal pelvis holds from 4 to 10 c.c., and amount of fluid is read off on the scale.

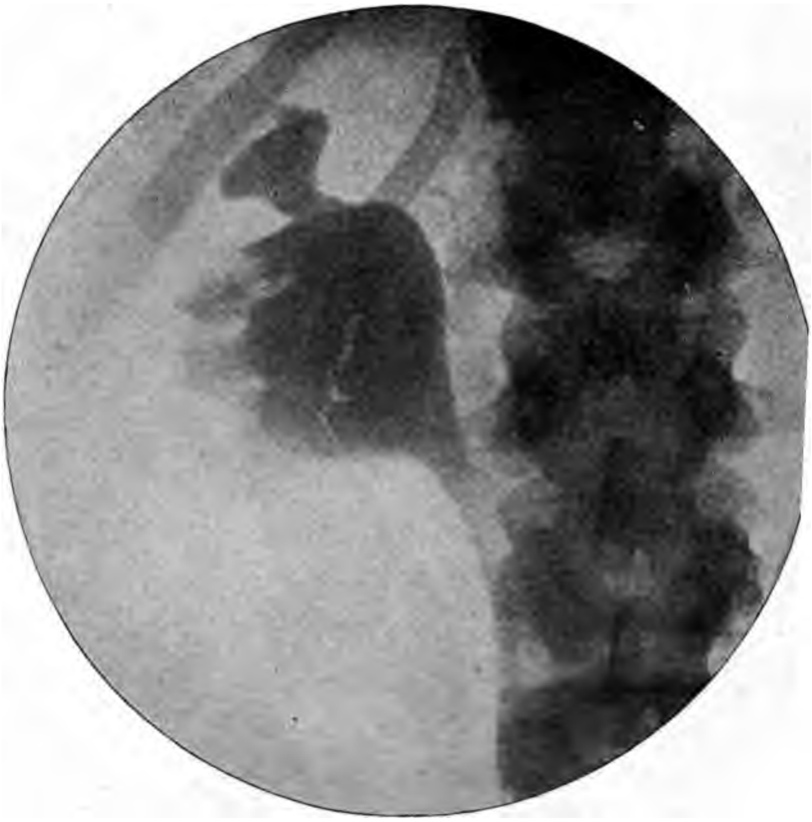

Fig. 13.—Radiogram showing hydronephrosis pyelography. (Courtesy of Dr. Eastmond

The patient is asked to report at once any feeling of fullnes discomfort in the back of the loin as an additional sign that the pe is entirely filled.

Pyelography is of great value in the differential diagnosis between renal and abdominal neoplasms, in the diagnosis of dilatation of the pelvis and ureters, in the detection of malformation of the urinary tract, and in the surgery of stone in the kidney, and the diagnosis of tumors within the kidney.

## DIAGNOSIS BETWEEN ABDOMINAL AND RENAL TUMORS

A pyelogram is of great assistance in differentiating between a renal tumor or an enlargement in some other organ.

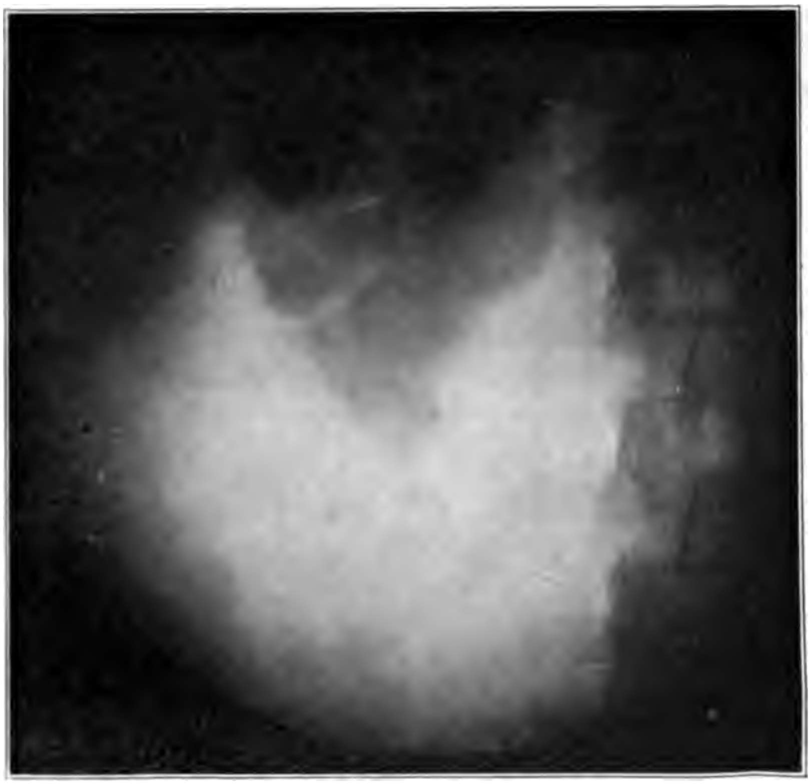

Fig. 14.—Pyelography. Pyonephrosis of kidney. (Author's case, Long Island College Hospital.)

If the shadow of the pelvis of the kidney is normal, it proves that the tumor must be extrarenal, or if the radiogram made after injection locates the pelvis of the kidney and the tumor is felt well below the margin of the ribs, the two can not be adjacent.

Finally the tumor mass will frequently cast a diffuse shadow in the radiogram, and if at some distance from the injected renal pel will settle the question of diagnosis.

## DILATATION OF THE KIDNEY PELVIS

Dilatation of the pelvis may be mechanical or inflammatory.

When inflammatory dilatation is present, it is due to tuberculo of the ureter or to calculus attended by suppuration, and the pel and calices are shrunken and irregular and the dilatation takes pl chiefly in the medullary and the cortical portion of the kidney.

Mechanical dilatation may be due to stone, strictures of the uret or kinks in the ureter from movable kidney, or to the pressure pelvic tumors.

The signs of early mechanical dilatation are: (1) The pel takes more than 8 to 10 c.c. of fluid. (2) A curved or kinked appe ance of the ureteropelvic junction. (3) A ballooning of the pel itself. (4) A flattening of the pyramids and a widening of t normal narrow necks of the calices.

The earliest symptom of dilating calices is an aching pain in t back of the loin sometimes accompanied by renal colic. If allow to go on, the kidney is destroyed by back pressure or suppuratic on this account the diagnosis should be made early by pyelograp and appropriate surgical treatment instituted before the kidney destroyed.

In advanced cases of hydronephrosis where the sac contain large amount of fluid, pyelography is distinctly contraindicated, w the dilatation can be determined by ureteral catheterizat (Braasch).

## STONE IN THE KIDNEY AND URETER

Kidd points out the value of pyelography in the surgery of r calculus, for the surgeon must know beforehand the exact posi of the stones, whether in the pelvis, the calices, or the ureter, an the kidney is shrunken and fixed, or dilated and movable. An ordi radiogram will frequently fail to disclose these facts, which ar sential for proper choice of the operative procedure, for if stone is in the pelvis, pyelotomy is indicated, but if the stone is dilated calix with thinning of the cortex, it is evident that the ki should be incised through the small area of thinned cortex and stone extracted with a minimum of drainage.

## RENAL TUMORS

A renal tumor of any size will almost always cause some alteration in the shape of the renal pelvis.

Braasch describes the deformity resulting; as, (1) Irregular distention of the entire pelvis. (2) Retraction or distention of one or more calices. (3) Retraction of the pelvis and upper ureter at the ureteropelvic juncture.

Another point of corroborative value in suspected tumor of the kidney is to find the pelvis situated in unusual positions, such as overlying the vertebral column or laterally displaced.

The ability to exclude a tumor of the kidney in a case of unilateral hematuria is very important, as in the event of not being able to determine the cause of the hemorrhage an explanatory nephrotomy must be undertaken for fear of losing a chance to remove an early neoplasm. In many such cases no definite cause can be found for the bleeding, and the wound has to be closed again. The operation which proved to be unnecessary might have been avoided by excluding a tumor by means of a pyelogram.

### BIBLIOGRAPHY

**Braasch:** Pyelography, 1915, W. B. Saunders Company.
**Burns:** Use of Thorium, Bull. Johns Hopkins Hosp., June, 1916.
**Kidd, Frank:** Pyelo-Radiography, Proc. Roy. Soc. Med., 1913, vii.
**Lewis and Mark:** Cystoscopy and Urethroscopy, P. Blakiston's Son and Co.
**Mason, J. M.:** Dangers Attending Injections of the Kidney Pelvis for Pyelography, Jour. Am. Med. Assn., 1914, lxii, 839.

# CHAPTER VI

## CYSTOSCOPY

Until the year 1879 the only means of studying pathologic changes in the bladder was upon the autopsy table, but the invention of the cystoscope by Nitze at this time marked an epoch in the progress of genitourinary surgery.

There are at present two forms of the cystoscope in use: one in which the observer looks directly at the object, through a tube provided with lenses or otherwise. The Brenner cystoscope and Howard Kelly's tubes are representatives of this class. *Second,* the cystoscopes with prisms inserted in the vesical end of the shaft, through which the observer sees the object reversed in the vertical diameter, as in the Nitze-Leiter instrument.

For merely observing the alterations in the bladder, the Nitze observation cystoscope is the most useful instrument, on account of its large field of view, and the Zeiss lenses with which the modern instruments are provided, correct the inverted image and give a wonderfully clear view of the interior of the bladder.

For ureteral catheterization opinions are divided as to the best instrument. With the direct-view instrument of the Brenner type, as modified by F. Tilden Brown or Cabot, it is possible to catheterize the ureters with great ease, provided they can be seen.

It often happens, however, that from various causes the ureter openings can not be brought into view, and consequently the catheter can not be introduced.

On account of the difficulty of finding the ureters with the direct-view instrument, the double catheterizing cystoscope of the Nitze type is in general to be preferred.

With this instrument the ureters are more readily found, but it requires more experience and a certain skill in technic to catheterize them.

It is of the greatest importance that whatever form of instrument is used it should be one by which both ureters can be catheterized simultaneously, for the present diagnostic methods as applied to diseases of the kidney demand a comparison between the right and left urines which are secreted at the same moment.

In cases of pyuria, especially when tuberculosis is suspected, it is usually better not to use the cystoscope at once for diagnosis, but to relieve the cystitis by washing the bladder with nitrate of silver, 1:1000, three times a week for a fortnight.

The urine should, during this time, be examined for crystals, pus, and tubercle bacilli.

After fourteen days of bladder-washing, when no improvement occurs, the patient may be examined with the cystoscope.

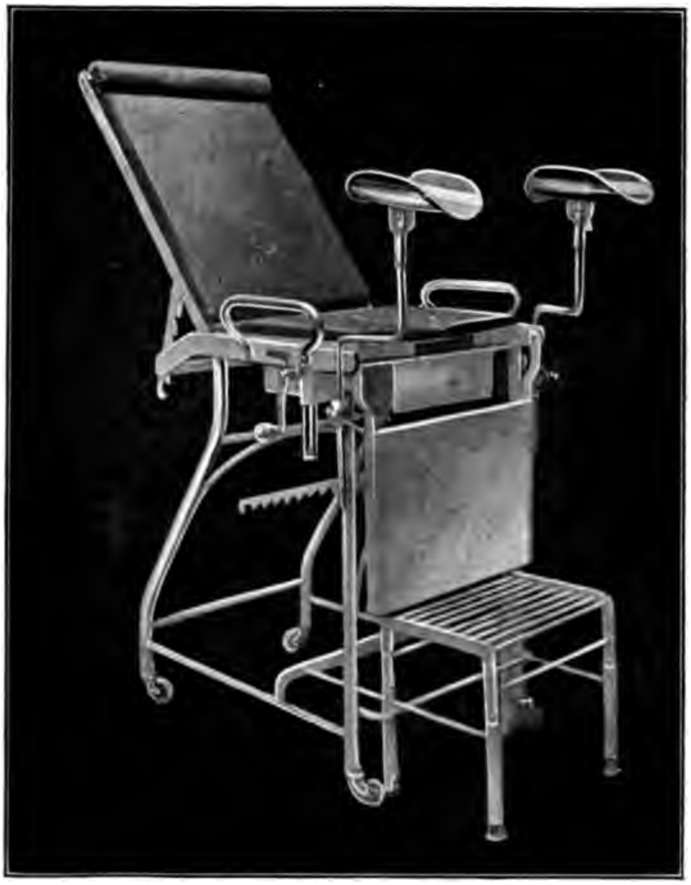

Fig. 15.—Urologic table for cystoscopy, urethroscopy, and irrigating dilatations. Used by the author and made after the German model by Tascarella Bros., 65 George St., Brooklyn.

If cystitis is present, it may be primary or secondary to disease in the kidneys. Hemorrhages or cystitis bullosa around the mouth of one ureter indicates that the kidney on that side is diseased.

To determine the condition of the kidneys, catheterization of the ureters is the only means of diagnosis.

The objection which was formerly urged against this procedure, on account of the danger of infection of the kidneys, is unfounded.

After the ureters have been catheterized the patient should drink three or four quarts of water, to wash out any organisms which may have been introduced, and urotropin, gr, vij, *t. i. d.*, should be given internally.

In most instances it is better to examine the bladder with an observation cystoscope and note the conditions, particularly the appearance of the ureters and their location, but to defer catheterizing the ureters if it should be necessary until another day.

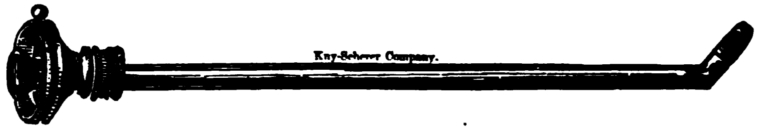

Fig. 16.—Nitze's observation cystoscope.

**Technic of Cystoscopy.**—There are certain conditions which are necessary to the performance of cystoscopy:

I. The urethra must be large enough to admit the cystoscope.

II. It is desirable for the bladder to hold at least five ounces; with this quantity it can be examined easily with the cystoscope. The minimum quantity of fluid which is necessary for cystoscopy is three ounces, but more fluid is necessary for catheterizing the ureters.

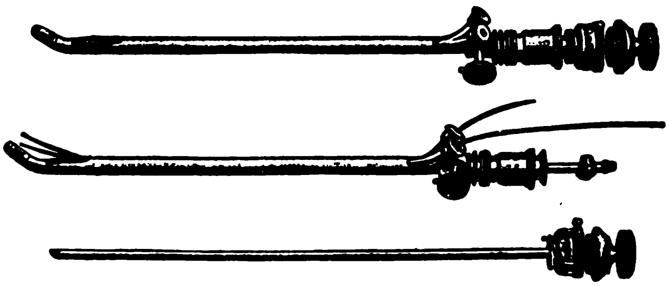

Fig. 17.—Nitze's double catheterizing cystoscope with attachment for irrigation of bladder.

III. A clear medium is required, for if the fluid in the bladder is turbid from blood or pus it is impossible to see anything.

The *contraindications* may be briefly stated as any acute inflammation, and in bladder tuberculosis extreme care with regard to traumatism and infection must always be exercised.

It is always well to proceed with the examination of the bladder in a systematic manner, and the following scheme is a convenient one to adopt:

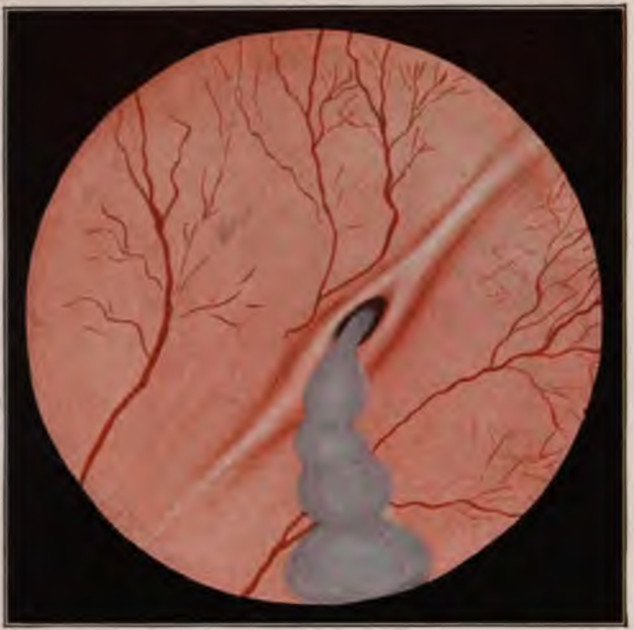

Fig. 1.—Mouth of ureter showing stream of indigo carmine issuing from it.

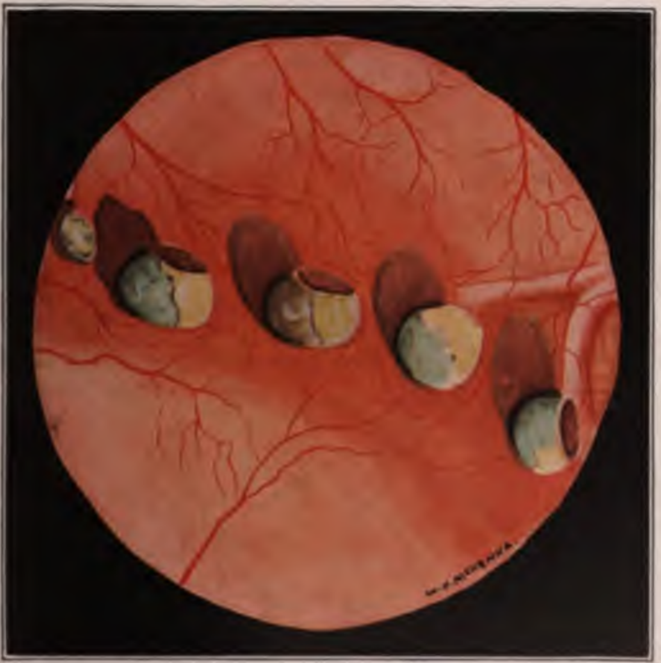

Fig. 2.—Multiple bladder stones in postprostatic pouch.

PLATE II.

1. Note capacity of bladder.
2. Form of sphincter of bladder.
3. Appearance of bladder.
4. Form of ureter openings.
5. If changes are present around ureter opening.
6. If pus or blood issues from the ureter.
7. Configuration of the floor of the bladder.
8. Examine posterior part of the bladder, by sinking the ocular end of the cystoscope.
9. Examine the bladder walls by turning the cystoscope around so that the beak points upward.

Immediately before the examination, the patient divests himself of trousers and drawers and lies on his back on a suitable table, with his legs resting on stirrups in the lithotomy position.

The urethra should be thoroughly irrigated with oxycyanide-of-mercury solution, 1:4000, and the bladder is first emptied of urine with a catheter and then irrigated to remove all pus and blood.

One dram of a 4 per cent novocaine solution is instilled into the posterior and anterior urethra with an Ultzmann syringe, or a 2 per cent eucaine solution is injected into the anterior urethra with a P-syringe.

The bladder is then filled through a catheter with from 4 to 8 ounces of sterile water or a solution of normal saline, 1:4000.

The electric current is turned on and the cystoscopic lamp tested. The current is then shut off, the instrument lubricated with glycerin, particularly the lamp and window covering the lens, and introduced. The light is then turned on and the examination begun. The first point which strikes the observer is the air bubble which forms at the time the bladder is filled and floats at the anterior and superior surface of the bladder. It serves as a useful landmark for orientation.

As most of the diseased processes occur in the trigone and about the ureteral openings, these parts are first inspected. After finding the air bubble, the beak of the cystoscope is turned down to an angle of 45° and the ureter of one side should automatically come within the field of vision; if it does not, the cystoscope may be pushed or drawn out or rotated slightly to bring the ureter into view. After one is found the other is easily located by turning the instrument towards the other side.

The conformation of the ureteral orifice often suggests disease of the kidney. Positive evidence of disease of the kidney, however, can only be attained by catheterization of the ureters or seeing a stream of blood or pus issuing from one or both sides.

The ureters differ greatly in appearance in eve usually appear as a narrow slit or they may be elevate papilla, again they may be so small as to be seen with

As the cystoscope is withdrawn toward the operat covers the window; this is the prostate, and if the farther withdrawn the light is entirely obscured, as enters the urethra.

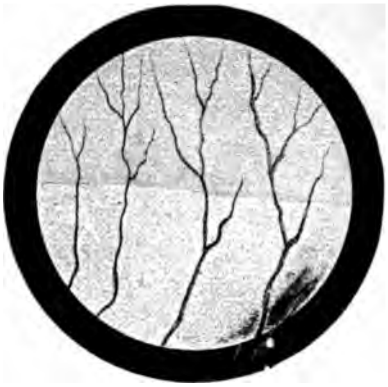

Fig. 18.—Posterior boundary of trigone and blood vessels. Normal bladder.

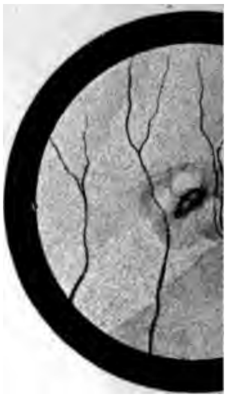

Fig. 19.—Orifice of ure Normal bl

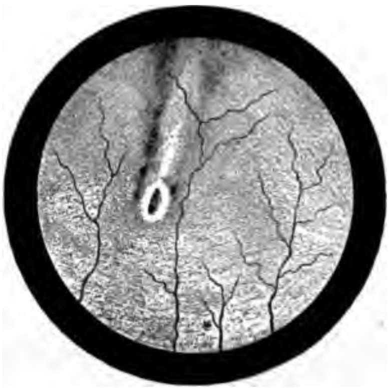

Fig. 20.—Ureter expanding as urine issues from it.

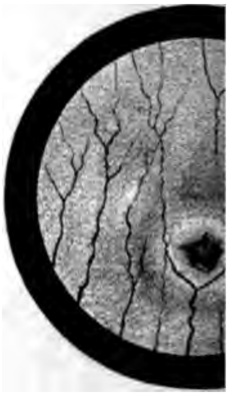

Fig. 21.—Ureter of old calcareous dege

The posterior and lateral lobes of the prostate examined for evidences of hypertrophy and a caref made of the region of the trigone and interureteral li ulcer or tumor, and finally a general inspection of t sides of the bladder should be made for tumors, trabec ticulæ or incrustations.

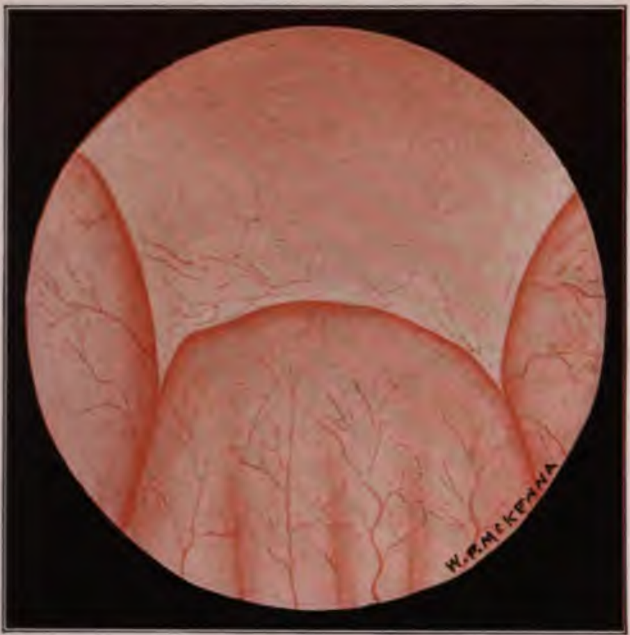

Fig. 1.—Hypertrophied prostate, posterior and lateral lobes.

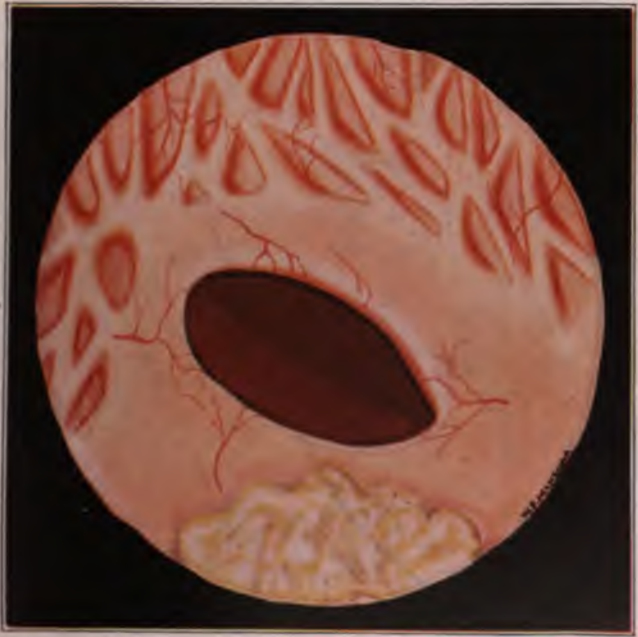

Fig. 2.—Trabeculated bladder. Cystic diverticulum. Coagulum of pus lying free in bladder.

PLATE III.

After the cystoscopic examination has been completed, the bladder should be emptied and washed out with a 1:4000 nitrate-of-silver solution, to avoid the danger of exciting cystitis.

## CYSTOSCOPIC APPEARANCES IN DISEASED CONDITIONS

### Acute Cystitis

Cases of *acute cystitis* are difficult to examine with the cystoscope, for the injection of a sufficient quantity of water to distend the bladder causes severe tenesmus and forces it to expel its contents.

Hence the cystoscope should not be used in acute cystitis, unless some urgent indication is present.

On introducing the cystoscope into an inflamed bladder, the observer notes that the normal grayish-yellow color is changed into a red, which varies from a pale to a blood red, and may be generally diffused or limited to certain areas.

The blood vessels show marked changes. In acute cases the vessels are seen engorged with blood, but in chronic cases the vessels are no longer to be recognized as such.

Superficial hemorrhages of irregular shape and size are to be seen in acute inflammations. In chronic cases, hemorrhages are also present, but less extensive and of a darker color.

The mucous membrane has lost its brilliance, is swollen and softened, and appears dull, spongy, and velvety and there is a distinct loss of the epithelial luster.

The diseased portions are in localized areas and do not extend equally over the whole bladder.

The swelling of the mucous membrane may be so great in spots that it bulges out into the bladder and may be mistaken for a polypus. More or less of the catarrhal secretion may usually be seen, adhering to the walls or floating free in the cavity of the bladder.

### Chronic Cystitis

In order to differentiate between acute and chronic cystitis, it is to be noted that in acute cystitis the blood vessels are highly engorged and the changes in the mucous membrane and the hemorrhages are limited to circumscribed spots, while in the chronic form the swelling and softening of the mucous membrane and involvement of a considerable area are prominent features.

The color of the mucous membrane is a dark red and there is a complete loss of the epithelial luster, so that it is very difficult to see

the interior of the bladder even with the full strength of the c
scopic light.

In severe cases flakes of mucopus may be seen attached t
wall which have been incorrectly described as diphtheriti
desquamated.

As a sequence of a severe acute attack when the inflamm

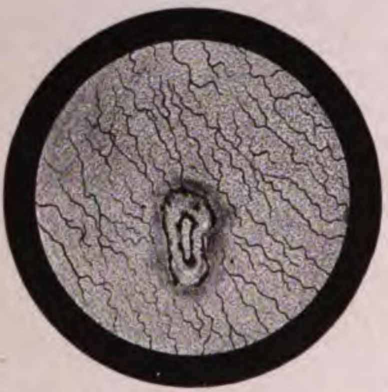

Fig. 22.—Cystitis. Blood extravasation and distended vessels.

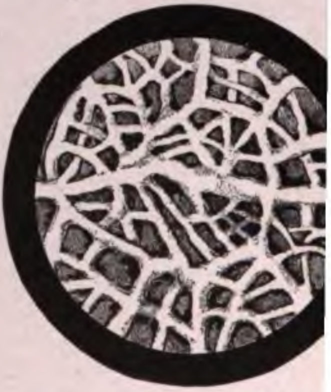

Fig. 23.—Trabeculated bladde

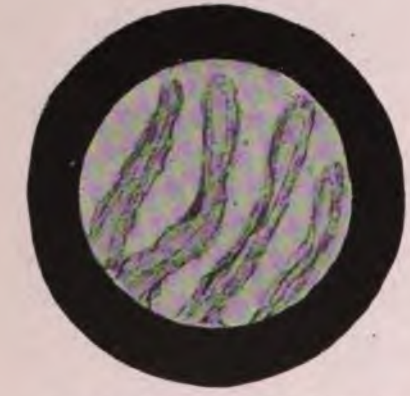

Fig. 24.—Villous papilloma of bladder.

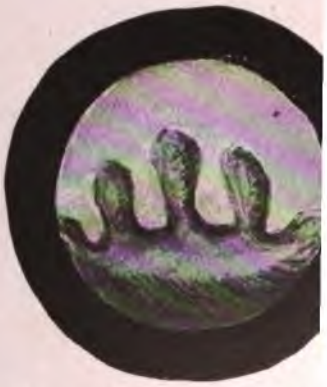

Fig. 25.—Papilloma from neck of

becomes chronic, areas of ulceration may be observed which
times become covered with incrustations of urinary salts.

In cases of very long standing the acute congestion has sub
and the mucous membrane appears stiffened and sclerotic; i
thelial luster is lost, but the wall reflects the light; the blood
have become largely obliterated and only an occasional one i

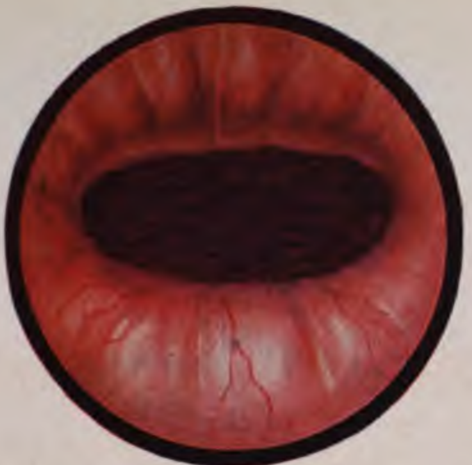

Fig. 1.—Normal appearance of the bladder neck as seen with the direct vision cystoscope. The first ring represents the end of the urethra; the dark central portion represents the darkened base of the bladder.

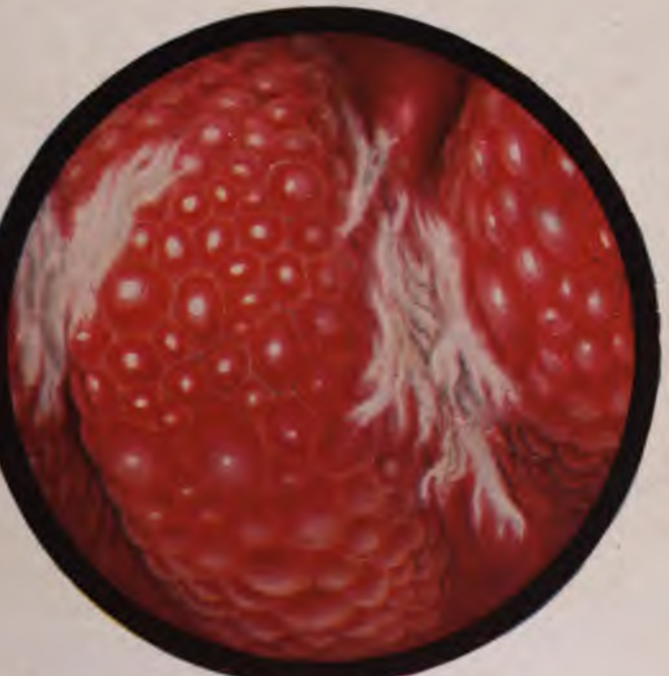

Fig. 2.—Syphilis of the bladder, showing bullous edema of the vesical mucosa. This condition seen in a patient of Jeanselme, came on coincidently with a secondary syphilis. While the patient still presented the roseola, she consulted Luys because of cloudy urine, and he found the lesions presented in this illustration. Examination made fifteen days later, during which time specific treatment had been given, showed that the bladder was restored to the normal condition.

PLATE IV.

(From Luys-Wolbarst.—*Cystoscopy and Urethroscopy.*)

### Trabeculation

Any condition of obstruction which prevents the bladder from emptying itself freely as in stricture, and hypertrophy of the prostate leads in time to a hypertrophy of the muscular fibers of the bladder wall so that the thickened muscular bundles project into the cavity of the bladder and can be seen as distinct ridges criss-crossing certain areas of the mucous membrane.

The same condition is noted in beginning tabes and the writer has not infrequently made a diagnosis of locomotor ataxia. with the cystoscope, which was subsequently confirmed by the neurologist.

The projection of the muscular bundles in tabetic cases is due to a want of balance between the detrusor muscle and the sphincter.

### Diverticula

Diverticula are sometimes congenital but more frequently the result of the thinned bladder wall, giving way between the hypertrophied muscle fibers and forming pouches in the wall.

They appear as deep or shallow cavities and are usually multiple when due to obstruction and straining and single if congenital.

### Tuberculosis of the Bladder

As tuberculosis of the bladder is practically always secondary to tuberculosis of the kidney and the infection is carried down through the ureters, the location of the first tuberculous nodules in the bladder is in close proximity to the ureters.

In an early case the first appearance is an area of congestion around the mouth of one ureter, later this becomes the seat of minute hemorrhages in which small grayish tubercles are found.

In course of time the nodules break down, leaving irregular punctured-out ulcerations with a grayish necrotic base which usually bleeds freely.

The changes in the mouth of the ureter on the affected side are also very characteristic of tuberculosis. The ureter is stiffened by periureteral inflammation and its opening becomes retracted and crater-like. Ulceration frequently takes place about the mouth so that its edges are ragged and covered with a grayish slough.

The retraction of the mouth of the ureter is very suggestive of a tuberculous process in the kidney.[1]

It was until quite recently supposed that the ulcerations around the mouth of the ureter on one side denoted disease of the kidney on the same side, but this has been disproved by Rovsing who finds ulcerations quite as frequent, if not more so, on the side of the healthy kidney.

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[1] Cystoscopy and Urethroscopy, Bransford Lewis, 1915.

This is an important clinical fact, as it shows that for a diagnosis of which kidney is diseased, we can not depend upon ulcerations around a ureter but must have recourse to ureteral catheterization.

### Simple Ulcer

This condition is not very common but sometimes occurs in youn persons. It should not be confounded with tuberculosis or the ulcera tions of cystitis. Its etiology is obscure but it may be due to a septi embolus deposited in the mucosa of the bladder.

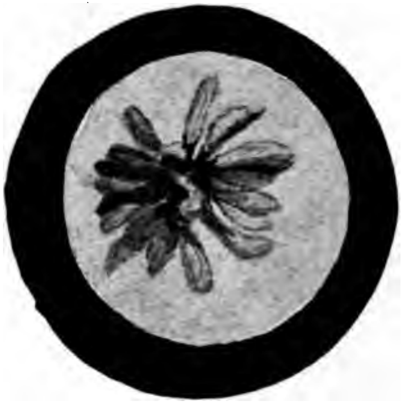

Fig. 26.—Cauliflower-shaped papilloma of bladder.

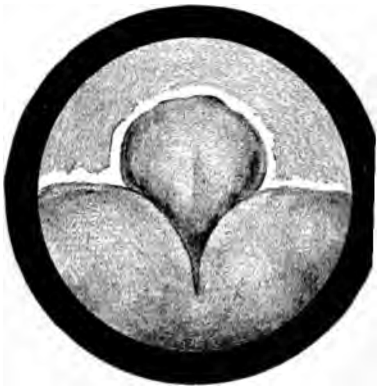

Fig. 27.—Hypertrophy of median lobe prostate.

It occurs singly, irregular in form from ½ inch to 1 inch diameter and is located in the region of the base of the bladder.

It is only possible to make a positive differential diagnosis fr a tuberculous ulcer by excluding the presence of the tubercle bacill

The above described ulcer must not be confounded with the ulc resulting from burning the bladder wall with the lamp of the cys scope in the hands of inexperienced men learning to do cystosco

This accident is not so common now since the introduction cold lamps but formerly we were frequently able to demonstrate su cases in cystoscopic clinics, where students were taught the art.

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[2] Jour. Am. Med. Assn., Dec. 21, 1912.

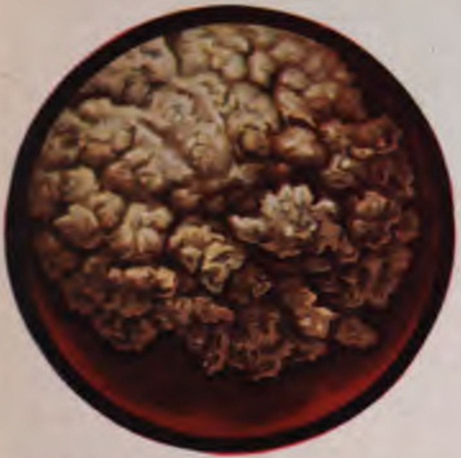

Fig. 1.—Phosphatic calculus of the bladder.

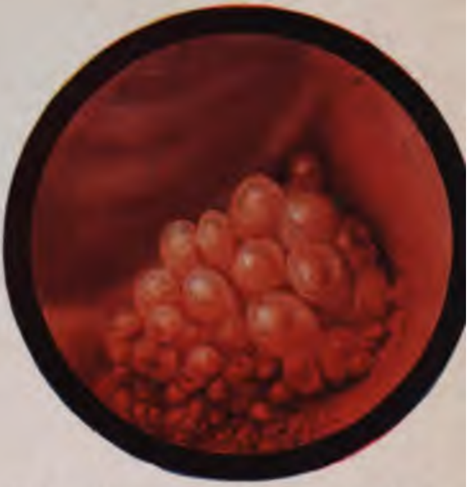

Fig. 2.—Cancer of the bladder secondary to uterine cancer.

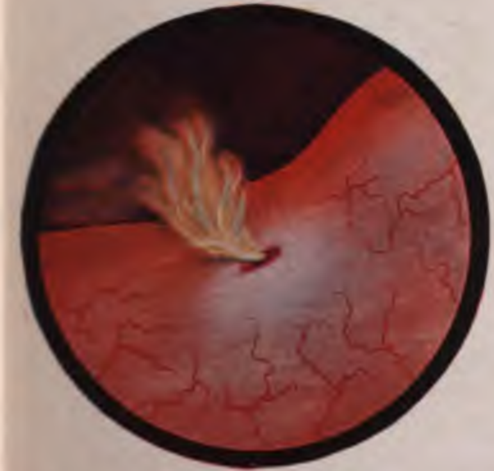

Fig. 3.—Purulent ejaculation from a ureteral orifice, in case of pyonephrosis.

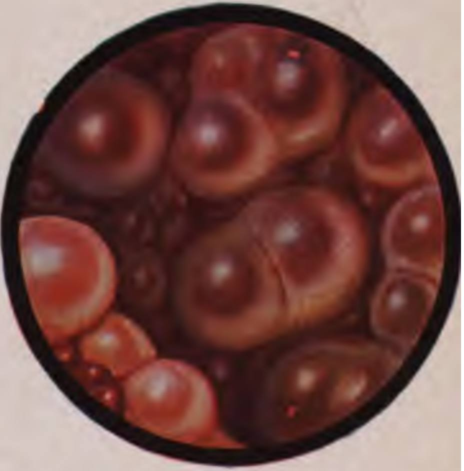

Fig. 4.—Bullous edema of the bladder, following uterine cancer in a patient in the service of Pozzi, at Broca Hospital, operated on twice for cancer of the uterine neck; after invading the vesicovaginal wall, the cancer perforated the bladder.

Plate V.

(From Luys-Wolbarst.—*Cystoscopy and Urethroscopy.*)

## Edema Bullosum

Edema bullosum occurs in the form of small translucent vesicles or bullæ the size of a pea or smaller, and denotes the presence of a submucous serous exudate.

It is found in cases of hypertrophied prostate, carcinoma, and tuberculosis.

It is always located in the trigone and when limited to one ureteral orifice is significant of tuberculosis.

## Calculus

Before the invention of the cystoscope the searcher was the method of discovering stone in the bladder, and the older surgeons, limited to a single instrument for diagnosis, became very expert in its use. But stones lying in a diverticulum or in the pouch behind a hypertrophied prostate were often overlooked, as they lay out of reach of the searcher.

Today the diagnosis of vesical calculus by means of the cystoscope is a procedure of ease, and the examination demonstrates not only the presence of stone but also shows the number, location, and, to a considerable extent, the nature of its formation.

The color of the stone is a guide to its constituents. Uratic calculi are pale yellow, phosphatic are white, and oxalates are brownish or nearly black. The number of stones present can not be accurately determined with the searcher, but can be counted with the greatest ease by means of the cystoscope.

It is difficult to estimate the size of a stone accurately with the cystoscope, as it apparently increases or diminishes with the focal distance of the instrument and a long experience in cystoscopy is required to gain a correct idea of the size.

By the use of the cystoscope we can inform ourselves as to whether the stone is freely movable in the bladder and suitable for crushing or if it is imbedded in a diverticulum, attached as an incrustation to the bladder wall or lying in the pouch behind a hypertrophied prostate.

## Hypertrophied Prostate

The author believes that every case of senile hypertrophy of the prostate should be examined cystoscopically before operation except in those instances where it is impossible to introduce the instrument past the projecting middle lobe or where the cystitis is so severe as to be a distinct contraindication. Much helpful information may be

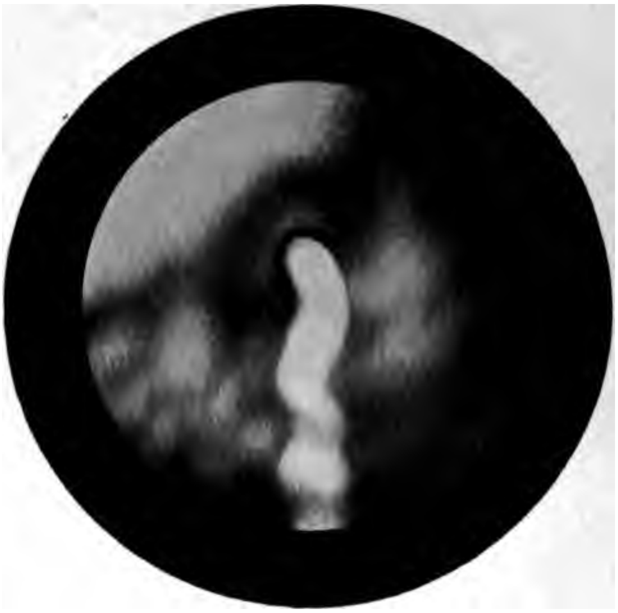

Fig. 28.—Ejaculation of thick pus, like a whirlpool, from a ureteral orifice (Nit
(From Luys-Wolbarst.—*Cystoscopy and Urethroscopy.*)

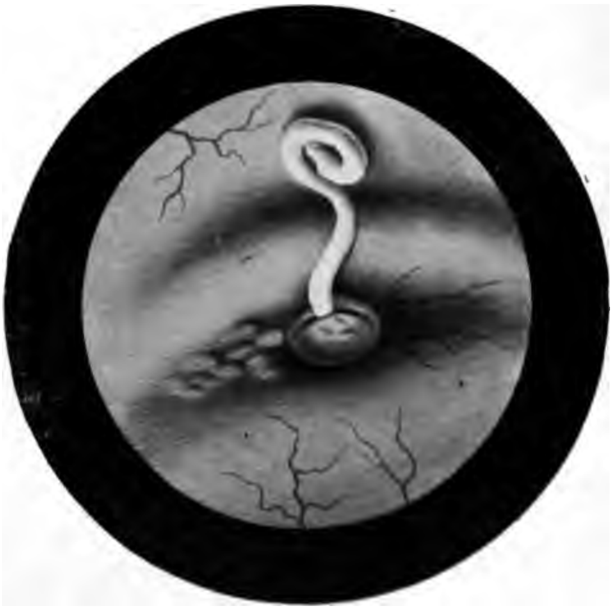

Fig. 29.—Ejaculation of pus from a ureteral orifice as from a tube of paint (Nit
(From Luys-Wolbarst. *Cystoscopy and Urethroscopy.*)

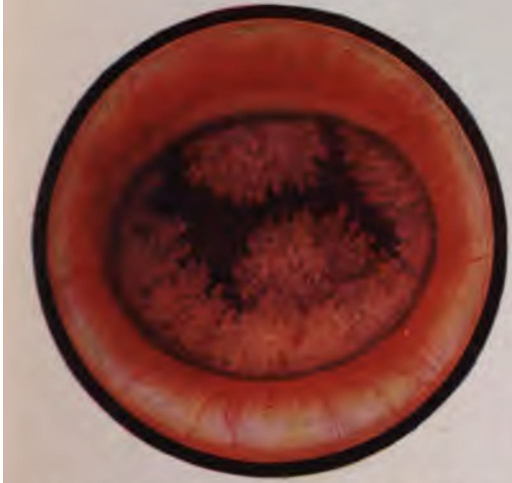

Fig. 1.—Large papillomatous tumors of the bladder neck.

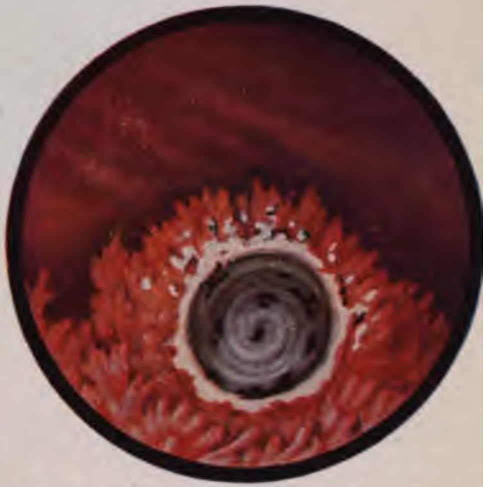

Fig. 2.—Application of the galvanocautery to the tumor at the lower part of the bladder neck. (Compare this with Fig. 1.)

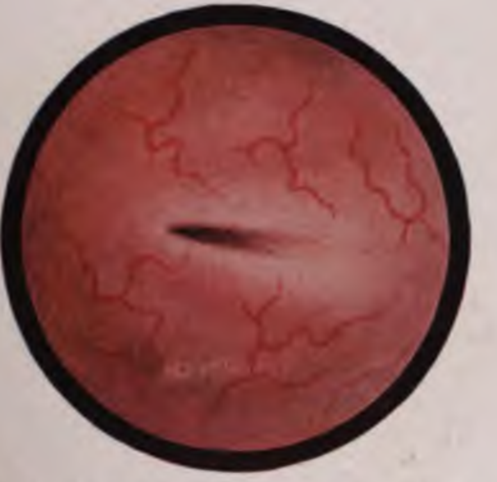

Fig. 3.—Appearance of a normal ureteral orifice.

PLATE VI.

(From Luys-Wolbarst.—*Cystoscopy and Urethroscopy.*)

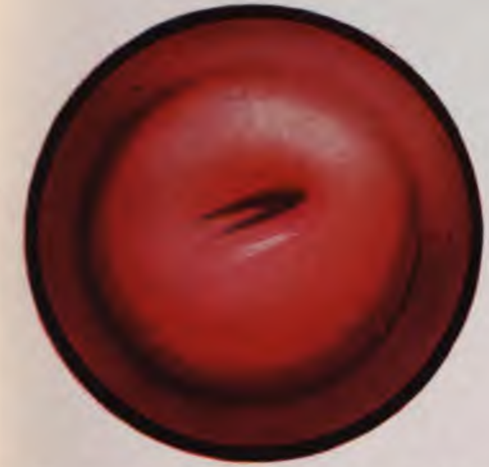

Fig. 1.—Normal appearance of a ureteral orifice seen with the direct vision cystoscope, and isolated in the lumen of the cystoscopic tube.

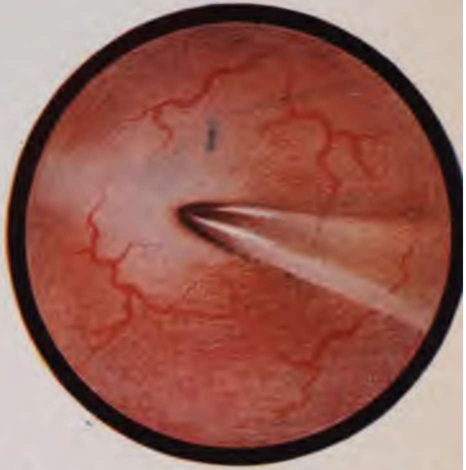

Fig. 2.—Ureteral emission of normal urine as seen with the direct vision cystoscope.

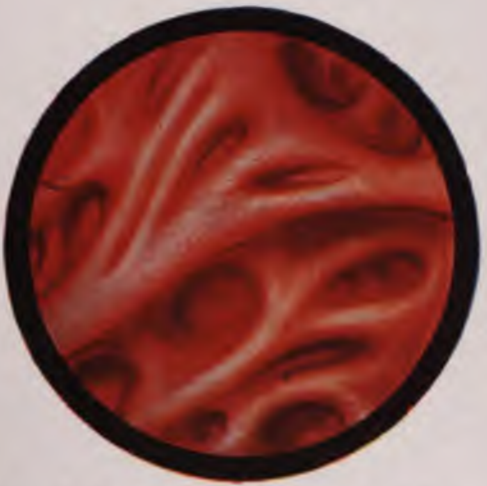

Fig. 3.—Trabeculated bladder. Typical view.

PLATE VII.

(From Luys-Wolbarst.—*Cystoscopy and Urethroscopy.*)

elicited by a cystoscopic examination, the shape and size of the hypertrophy, presence of stone, amount of trabeculation and diverticula, and while it is not absolutely essential, it is very desirable as a means of studying the case as a preoperative preliminary.

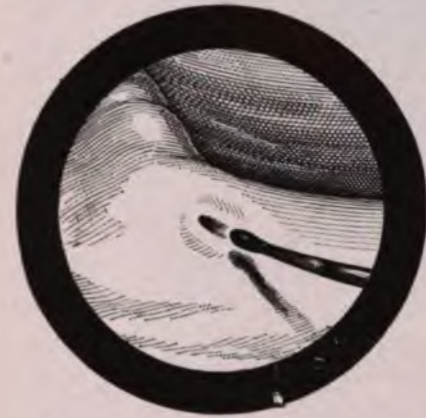

Fig. 30.—Ureteral catheter in favorable position for easy entrance into the ureteral orifice. (From Luys-Wolbarst.—*Cystoscopy and Urethroscopy.*)

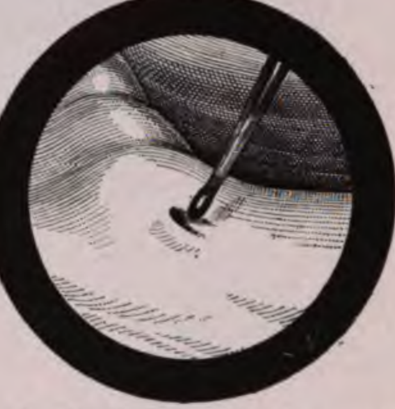

Fig. 31.—Ureteral catheter in poor position, and can not enter the ureteral orifice without great difficulty. (From Luys-Wolbarst.—*Cystoscopy and Urethroscopy.*)

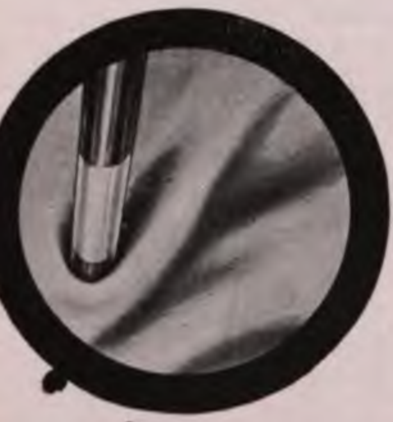

Fig. 32.—The ureteral catheter has entered the right ureter. The button indicator on the cystoscope is well placed (at eight o'clock). The ureteral orifice is in line with its prolongation (Gorodichze and Hogge). (From Luys-Wolbarst.—*Cystoscopy and Urethroscopy.*)

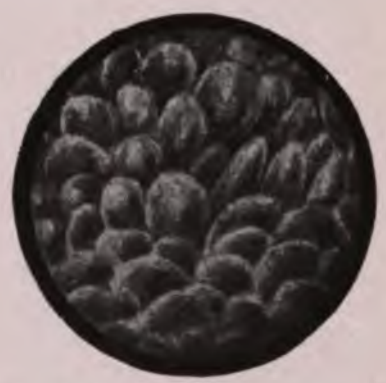

Fig. 33.—View of the bladder mucosa in bullous cystitis, accompanying a foreign body in the bladder. (This cystitis covers two-thirds of the bladder.) (Le Für.) (From Luys-Wolbarst.—*Cystoscopy and Urethroscopy.*)

In a few cases, however, where rectal palpation shows no enlargement of the gland and yet when the patient can not empty his bladder, the cystoscope will show an enlarged middle lobe, which blocks the vesical outlet and prevents the outflow of urine.

Without the cystoscopic examination it is impossible to differentiate such cases from arteriosclerosis of the vessels of the genito-urinary tract, with consequent degeneration of the detrusor muscle, which presents a similar clinical picture.

### Tumors of the Bladder

Of all the pictures seen with the cystoscope, bladder *tumors* are the most characteristic and well marked, as they project prominently from the surface of the bladder wall. They may be sessile or pedunculated, and are usually located near the orifice of a ureter or the urethra.

Generally the tumors are multiple, and a complete examination should include the entire bladder.

Hemorrhage quite often interferes with the view, and one of the ordinary forms of the irrigating cystoscope may be required in order to see.

A solution of adrenalin 1:1000 injected into the bladder, with stypticin internally, is often of assistance in controlling the hemorrhage so that a clear field may be obtained. Often, however, the hemorrhage is so free that the examination can not be made and th patient must be put to bed, wearing a permanent catheter for severa days until the bleeding has ceased. An irrigating cystoscope whic permits free washing of the bladder before the examination is great help in such cases.

From the cystoscopic appearances a differential diagnosis betwee simple papilloma and carcinoma can not be made, but often a fai idea of the nature of the growth may be obtained from its appearance A tumor with long waving fronds like seaweed occurring in a youn person is nearly always benign, while a growth with a broad sessil base in an elderly person is most apt to be malignant. The diagnosis however, can only be made by the pathologist examining a section o the base after removal.

## CATHETERIZATION OF THE URETERS

For this purpose one of the forms of catheterizing cystoscopes i employed. The ureters are brought into the field of vision and th catheters are introduced into both open ureteral mouths.

They are allowed to remain there for a few minutes, or until enoug urine has been collected in a bottle for examination, and then th catheters are withdrawn.

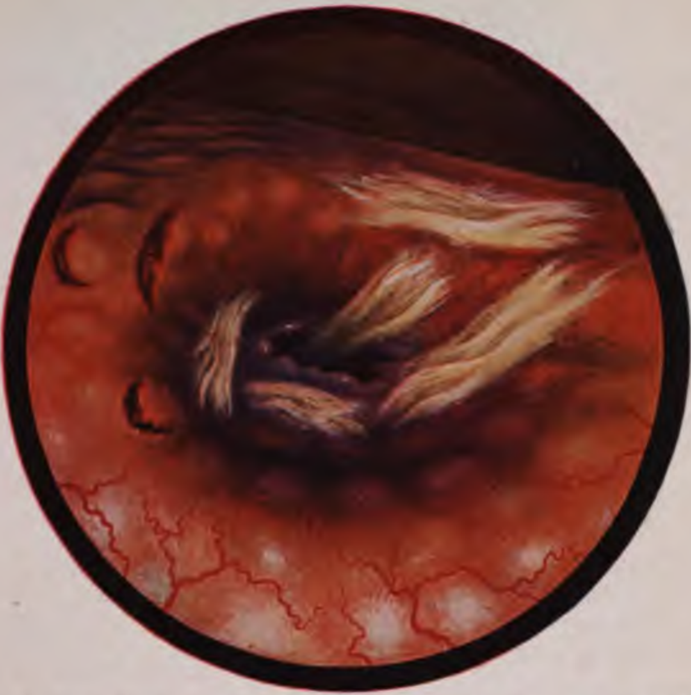

Fig. 1.—Typical aspect of a tuberculous ureteral orifice, indicating an accompanying tuberculous pyonephrosis. A few ulcerations resembling nail scratches are seen outside of the ureteral orifice.

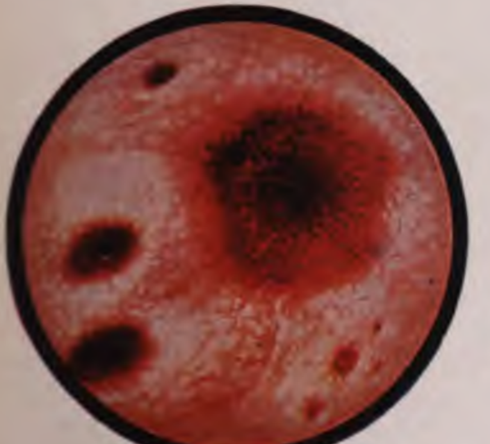

Fig. 2.—Tuberculous ulcerations of the bladder seen with the direct vision cystoscope.

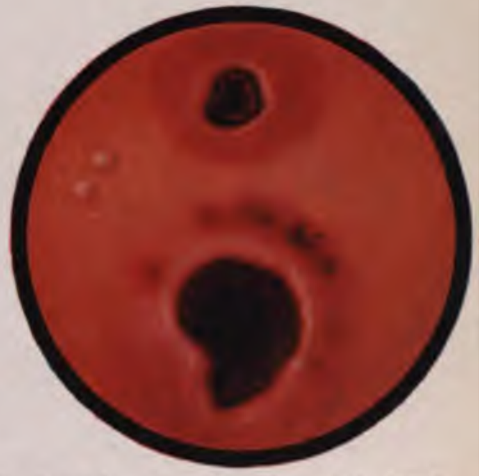

Fig. 3.—Tuberculous ulcerations of the bladder seen with the direct vision cystoscope.

PLATE VIII.

(From Luys-Wolbarst.—*Cystoscopy and Urethroscopy.*)

There are many forms of catheterizing cystoscopes in use, and each one has its own special advantage; but with any instrument a very considerable amount of practice is required to find the ureters in every case.

To find the ureters with a cystoscope of the Nitze type, if the beak be pointed upward, a bubble of air will be seen floating on the surface of the water in the bladder. After finding the air bubble, which serves as a landmark, the beak of the cystoscope should be turned to the right or left so that it points downward at an angle of 45 degrees. This will usually bring one ureter into the field. If the ureter does not appear at once in the field search should be made for it by pushing the cystoscope farther into the bladder or withdrawing it along the same line, and in this way the ureter may be brought into view.

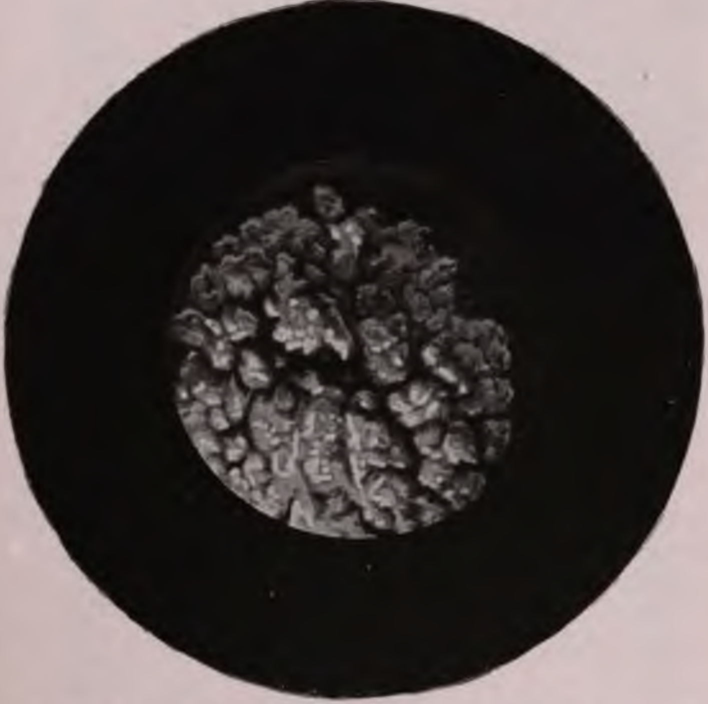

Fig. 34.—View of a phosphatic calculus seen through Luys' direct vision cystoscope. (From Luys-Wolbarst.—*Cystoscopy and Urethroscopy.*)

Another important landmark is the interureteral line, which is the posterior boundary of the trigone, and is formed by the pink mucous membrane of the bladder shading off into the lighter membrane of the trigone. The ureteral openings are found at its lateral terminations.

They appear as slits situated on a slight elevation and are recognized by a swirl of urine which is seen issuing from their mc

In cases where the ureters can be seen with the cystoscope not difficult to learn to catheterize them with a little practic in cases of contracted or very irritable bladder, it may be impo to find the ureters and unless distinctly seen, the catheter can n introduced. In cases of free hemorrhage the ureter mouths ca be found and in hypertrophied prostate the openings are conc behind the prostatic outgrowth.

The technic of introducing the catheters into the ureters m divided into three steps:

1. Find the ureter mouths.
2. Bend the catheters by means of the trigger attached t instrument.
3. Advance catheter into ureteral mouth.

On account of conditions above described, catheterization of

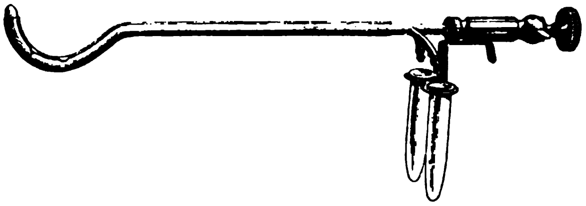

Fig. 35.—Luys' segregator closed before introduction into bladder.

ters is sometimes impossible. In the event of being able to intro a catheter on one side, the urine from the other kidney can be quired by leaving a catheter in the bladder while the urine from other kidney is being drawn off through the ureteral catheter, chromocystoscopy is here at times very helpful.

## SEGREGATION OF URINES

The difficulties attendant on ureteral catheterization led to employment of other means to secure the separate urines from c kidney.

All of these devices act by establishing a watershed in the blad with a ureter on either side, so that the drops of urine coming d from each kidney will flow outside the body without being mixed.

Luys's instrument may be taken as the type. It consists of instrument with a marked Béniqué curve, which after introduct into the bladder is arranged so that the rubber diaphragm, with wh

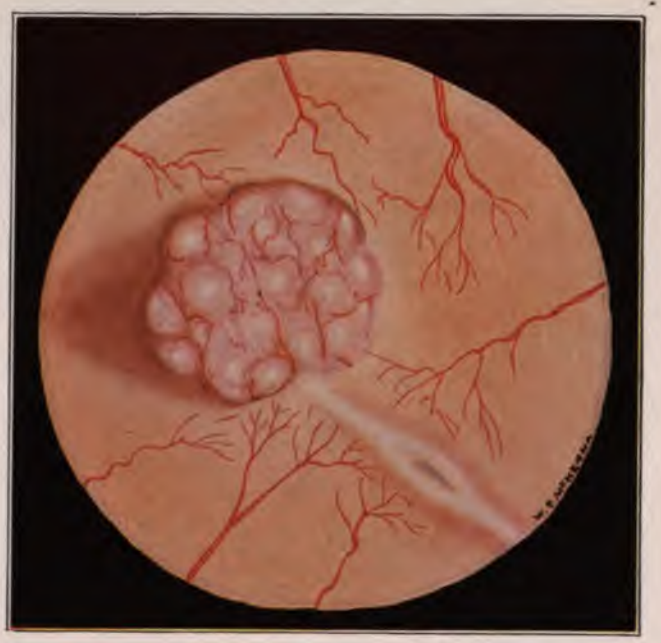

Fig. 1.—Papilloma of bladder.

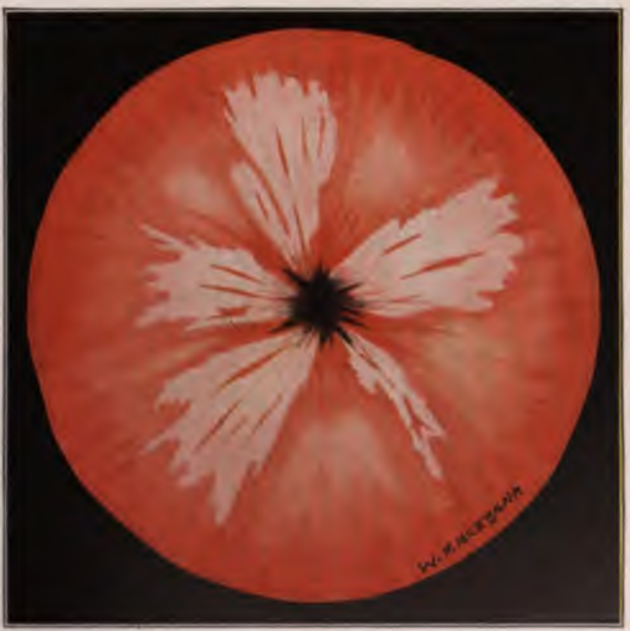

Fig. 2.—Leucoplakia urethritis. "Psoriasis mucosa." (Oberlaender.)

PLATE IX.

it is provided, is stretched, dividing the bladder into two halves with a ureter on either side.

The various urinary separators are occasionally useful, but are not free from disadvantages.

In the first place they can only be used in a healthy bladder whose mucous membrane is free from blood and pus; otherwise, the greatest errors can arise; for this reason a cystoscopic examination must always precede their use.

Their introduction is somewhat painful, and above all the reliability of the separation of the urines is not always free from doubt, for the rubber membrane may tear, or the instrument may not lie close against the bladder wall, leaving a communication between the two halves, through which the urine flows.

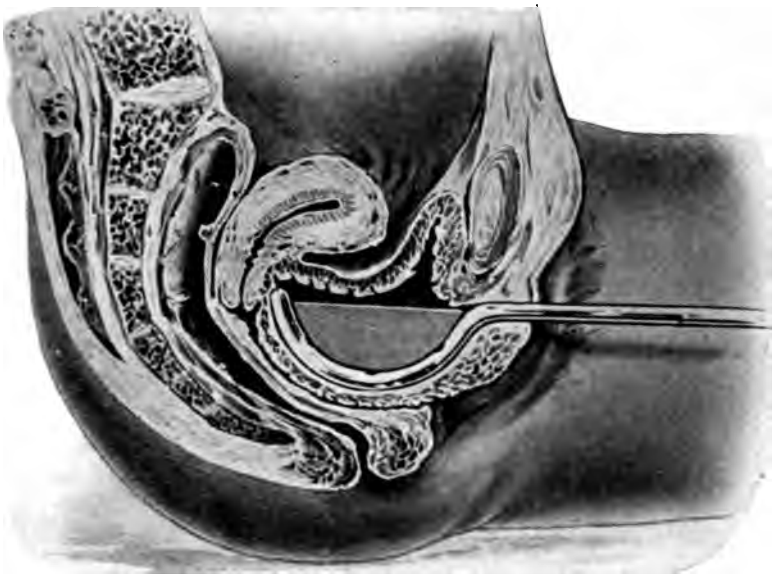

Fig. 30.—Luys' segregator opened in bladder.

On these accounts the use of the separator may be limited to the cases where ureter catheterism is impossible, and if it is used the findings may only be considered reliable when the urine from one side is perfectly normal, while that from the other side shows the changes of disease.

In cases when a differential diagnosis between the function of the two kidneys is necessary, rather than depend upon any other instrument than the ureter catheter the **chromocystoscopy** of Voelcker and Joseph is to be preferred.

This test was based upon the original experiments of Heidenhain upon animals with indigo carmine and applied practically to the diagnosis of kidney functional activity by Voelcker and Joseph.

The test is made by dissolving an indigo carmine tablet in 10 c.c. of water and injecting it into the buttocks.

In a normal case the urine from both kidneys is colored a strong blue simultaneously in from five to eight minutes. If blue urin appears on one side within the normal limit of time and the blue i delayed on the other side for some time afterward and then onl appears faintly, it is evident that secreting capacity of the kidney o the delayed side is impaired. A delay of the blue appearance on bot sides does not of necessity mean disease of both kidneys, but may b due to some other cause.

One great advantage of this test besides its accuracy, for it seldom fails to show disease of one kidney when present, is its simplicit Catheterization of the ureters is not necessary. All that is neede after injecting the blue is to watch the ureteral orifices with the cystoscope and note the time when the blue appears on each side.

Before making the test the patient must abstain from drinkin any water for five hours; otherwise, the excretion of blue is delaye on both sides.

## CHAPTER VII

## URETHROSCOPY[1]

The changes which are disclosed upon examination with the urethroscope are not of a very striking nature, and a good deal of practice is required to detect the slight differences between normal and diseased conditions.

The urethroscope has only a diagnostic value in the anterior urethra, for the deep-lying infiltration and the glandular and periglandular changes upon which the disease of the mucous membrane depends can not be influenced by applications made upon the surface. In the posterior urethra, however, the results of applications of nitrate of silver are often brilliant.

The recent invention of an electric light which gives a bright illumination without heat has resulted in a form of urethroscope with which a very satisfactory view of the urethra can be obtained.

The patient lies on a suitable table, with his feet resting on a stool. The tube with the obturator is introduced into the urethra, and when the obturator is withdrawn the electric light is inserted into the tube and carried down to its end.

As the tube is slowly withdrawn the mucous membrane rolls over its end and can be thoroughly inspected.

### NORMAL APPEARANCES OF THE ANTERIOR URETHRA

All endoscopic pictures of the urethra consist of two essential parts.

1. The central figure.
2. The surface of the mucous membrane.

The central figure is the opening at the apex of the funnel-shaped figure which the urethral walls assume beyond the end of the endoscopic tube. Its shape denotes whether the submucous tissues are free from infiltration or not.

The folds of mucous membrane radiate from the central figure outward toward the periphery like the spokes of a wheel. Their thickness and number indicate if the mucous membrane be infiltrated, and are of diagnostic importance. Longitudinal red stripes running toward the central figure are also noted. and indicate a normal u trated condition of the mucous membrane.

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[1] For the material in the following chapter, the author wishes to acknowledge his indebtedness to *Die Gonorrhoe des Mannes*, by Dr. Hans Wossidlo, Berlin, 1903, and *Gonorrhoea and Its Complications*, by Dr. Georges Luys, 1903.

The surface of the mucous membrane is smooth and glis and with a distinct luster: its color is ordinarily pale and ros if normally hyperemic may appear distinctly red or purple, w being diseased.

The openings of *Morgagni's crypts* appear in the roof of th thra as red specks or small slits as large as a pinhead. but the of Littré's glands are not visible in a normal case but become inent and congested when affected by inflammation.

**The posterior urethra** presents substantially the same a

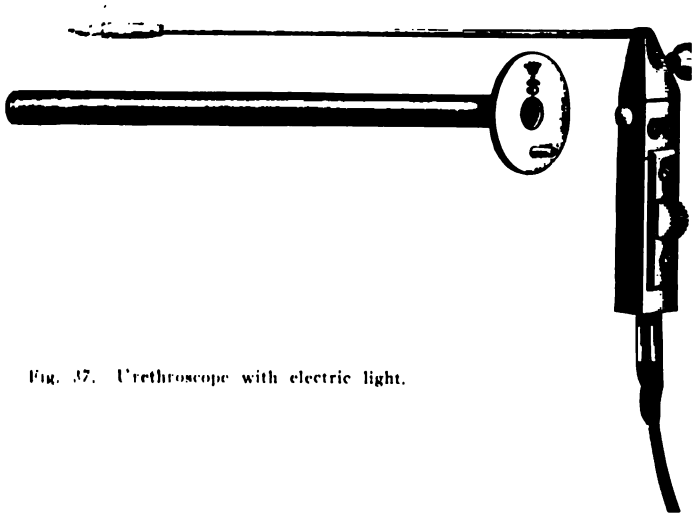

Fig. 37. Urethroscope with electric light.

ances as the anterior, except that in addition the *verumontan* colliculus seminalis is seen upon the floor of the urethra, l like a fold of mucous membrane.

In exceptional cases the ejaculatory ducts can be seen as litt alongside the verumontanum and the utriculus is often obser a depression on its anterior surface.

A small depression called the prostatic fossette, lies poste the verumontanum, extending back as far as the neck of the b The prostatic fossette is often the seat of an inflammation in c urethritis, and should always be carefully examined.

By means of the urethroscope Oberlaender classifies chroni orrhea into two groups of inflammatory processes:—

1. *Soft infiltration*, which consists in a submucous infiltra

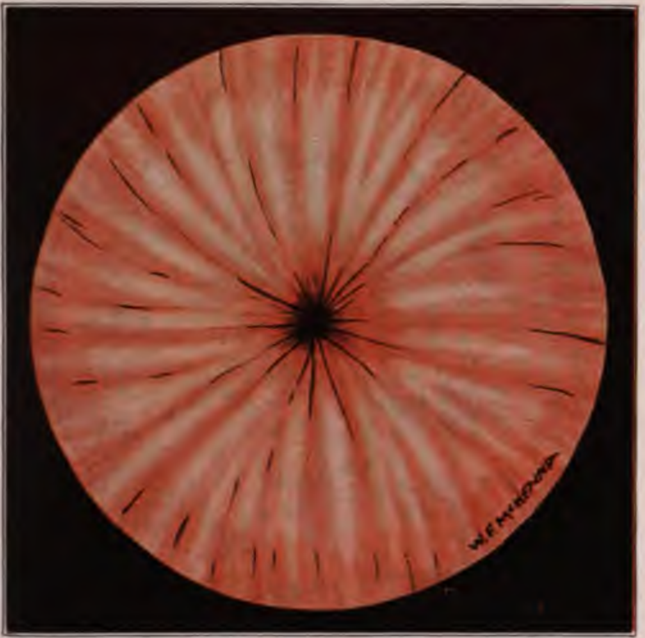

Fig. 1.—Normal urethra.

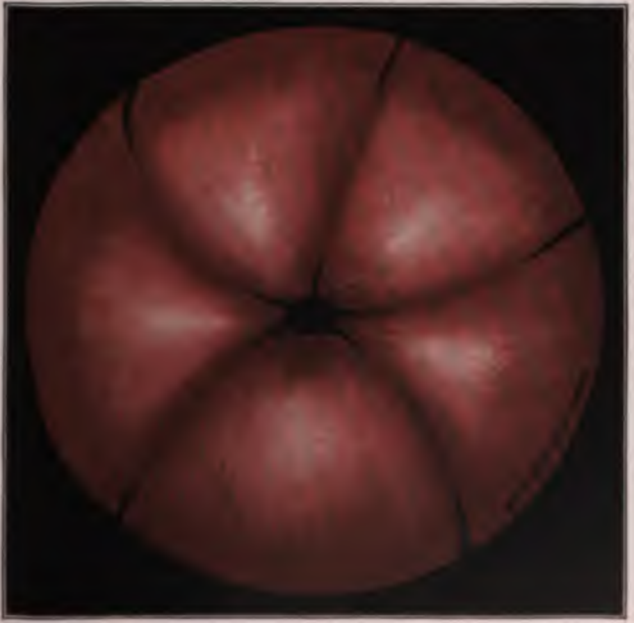

Fig. 2.—Soft infiltration.

PLATE X.

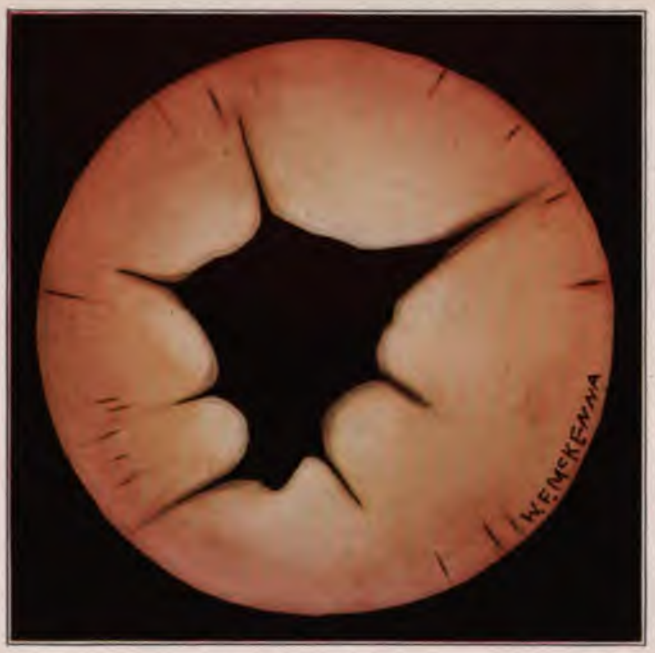

Fig. 1.—Hard infiltration.

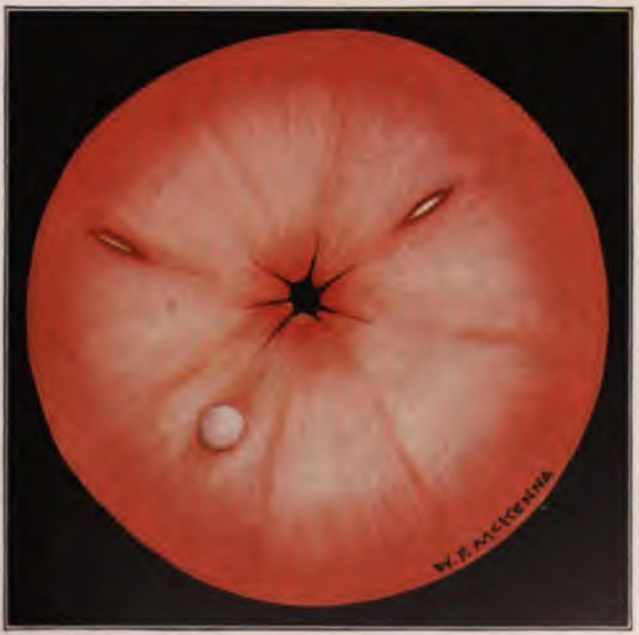

Fig. 2.—Glandular urethritis, mixed form. Two Morgagni crypts open. One converted into closed cyst.

PLATE XI.

The *epithelium* on the diseased spots shows an increased luster, in the beginning, but in time desquamation takes place and it becomes thinner and more friable. Its polish disappears and it becomes rough and opaque and is thrown off, leaving spots denuded of epithelium. On isolated spots the epithelium has entirely disappeared, leaving small *erosions*, or bright red granulations which bleed easily. Particularly in the region of the bulb we find, after the rest of the urethritis is cured, granulations which are a cause of the persistent shred formation.

The softened congested mucous membrane, as may be expected, does not lie in as many folds as normal. The long folds are obliterated, and in place of the numerous fine folds radiating from the central figure, we see only three or four broad, softened folds.

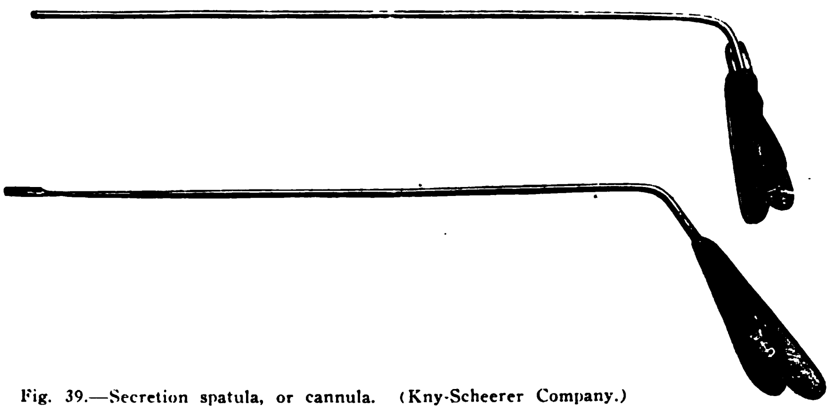

Fig. 39.—Secretion spatula, or cannula. (Kny-Scheerer Company.)

The central figure presents itself as a wide and gaping opening, with the mucous membrane often bulging into the end of the tube, or it may be a crescent-shaped slit which is nearly closed.

The inflammation of Morgagni's crypts shows itself through softening and hyperemia of their mouths. These appear as red eminences pinhead size, with swollen walls, and often discharge a mucous or purulent secretion.

It is easy to secure the secretion for microscopic examination by the *secretion spatula,* or *cannula.*

When the mucous membrane is very soft and hyperemic it is difficult to see Morgagni's crypts, and Littré's glands are never visible with soft infiltration.

**Hard Infiltration.**—The second stage of the chronic inflammatory process begins with the appearance of connective-tissue fibers in th round-celled infiltration, and is the so-called *hard infiltration* of Oberlaender.

In the beginning, when the amount of connective tissue present is slight, and the hyperemia and swelling of the mucous membrane are marked, the urethroscopic appearances are those of the soft infiltration, but as the submucous connective-tissue infiltration thickens, the blood circulation in the mucous membrane is shut off and it loses its bright red color as well as its turgescence and elasticity.

In the worst cases, as a result of the connective-tissue hyperplasia and scar-tissue contraction, the mucous membrane on the diseased spots is converted into a rigid, resisting tissue.

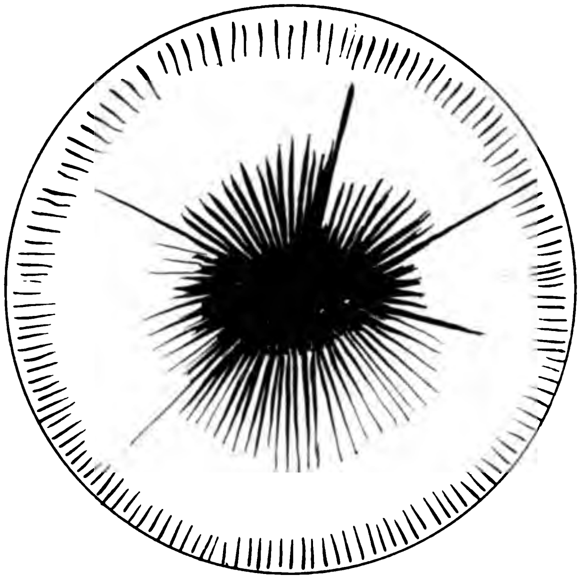

Fig. 40.—Urethroscopic picture of soft infiltration of the mucous and submucous tissues. The central figure is wide and gaping, and the folds of thickened mucous membrane are few in number and coarse and broad.

These different phases of development give, naturally, different urethroscopic pictures.

On introducing the tube one feels the resistance caused by the diminished dilatability of the walls, until as the stricture progresses, it may not be possible to introduce even the smallest tube.

A change in the *color of the mucous membrane* is also noted with the urethroscope.

When the infiltration is slight in amount, the diseased spots appear paler and more anemic than the healthy portions; with increasing thickness of the infiltration, the color becomes grayish white or yel-

lowish white; and by marked stricture formation, a uniform
white appears.

Under the disturbances of nutrition the *epithelium* also suffer

In the description of the pathologic anatomy of chronic gonor
the change of cylinder epithelium into compact, many-layered,
mous epithelium and its cornification has already been descr

Slight degrees of hard infiltration are characterized by a di
tion in the normal luster and transparency of the epithelium.
consequence of the desquamation, the surface appears stippled
uneven.

As the process extends it tends to localize itself on the mos

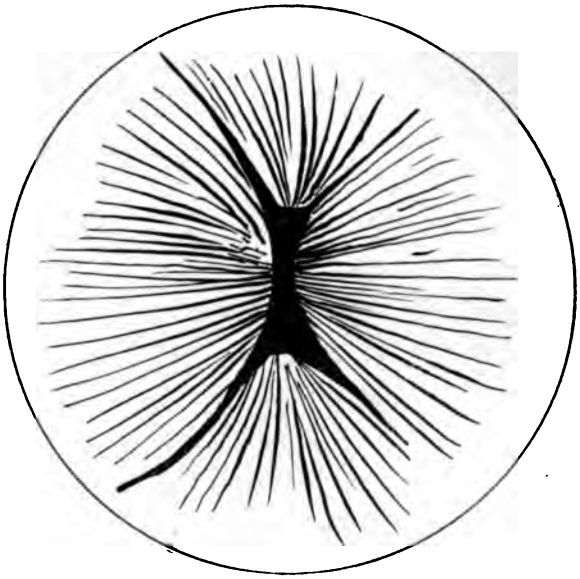

Fig. 41.—Urethroscopic picture of hard infiltration of the submucous tissues. The figure is open, gaping, and very irregular in shape.

eased spots, and in severe cases extends over a considerable ar
that finally a thick epithelial layer, or pachydermia, develops.

Under the urethroscope, the epithelial surface appears irreg
lumpy, with these high degrees of infiltration.

In other cases one finds various large, round, pearl-gray-co
spots as large as a pinhead, which rise abruptly from the m
membrane.

As a result of the infiltration, the thickened mucous membra
no longer able to lie in *longitudinal folds.*

By slighter grades of infiltration, four to six broad, coarse
may be noted, and in cases where the infiltration is more marke

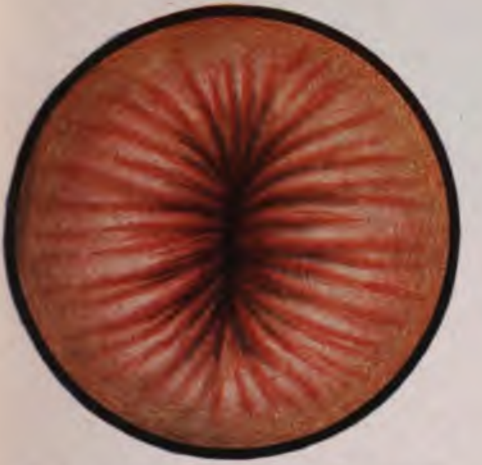

Fig. 1.—Normal appearance of the urethral bulb. The central figure takes on the form of a vertical cleft; the appearance of this region is highly characteristic.

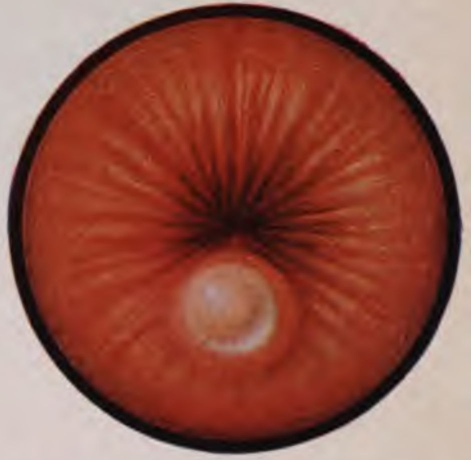

Fig. 2.—Enormous cystic gland of Littré easily destroyed through vigorous dilatations.

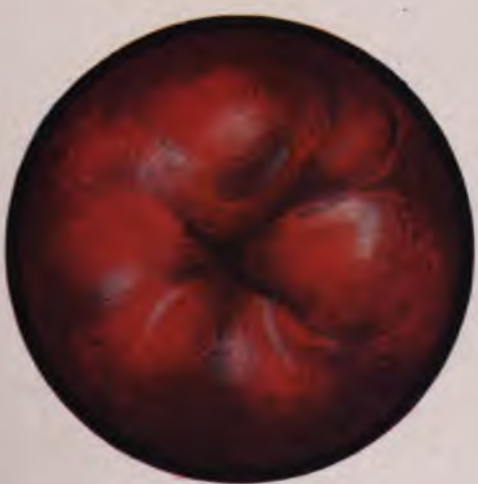

Fig. 3.—Soft infiltration of the urethra (typical urethroscopic aspect). The puffed up, oozing masses have an appearance similar to a mass of hemorrhoids.

PLATE XII.

(From Luys-Wolbarst.—*Cystoscopy and Urethroscopy.*)

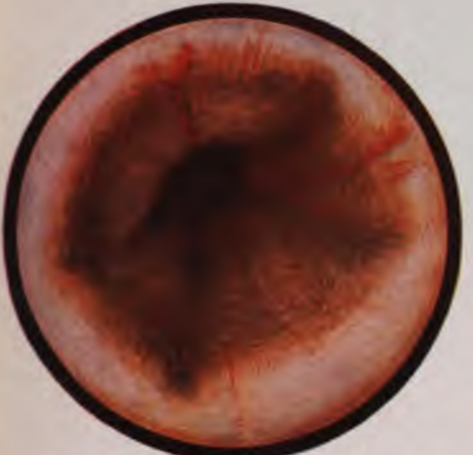

Fig. 1.—Stricture of the urethra. Shows the pasteboard-looking appearance of the urethral walls.

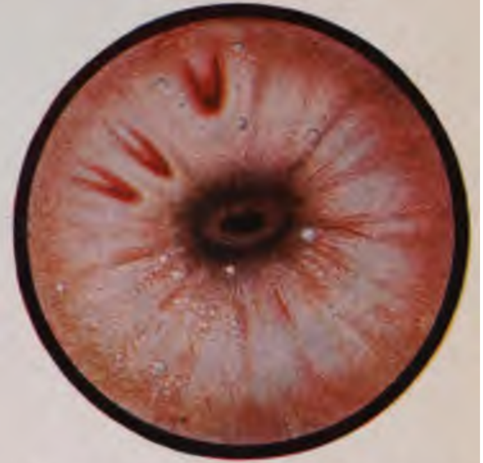

Fig. 2.—Cystic and purulent Littré's glands. Looking at this picture one can readily understand the therapeutic importance of forcible dilatation, which breaks up these inflamed glands.

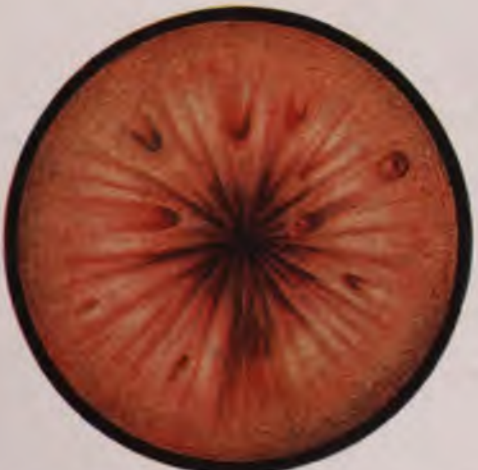

Fig. 3.—Morgagni's lacunæ and Littré's glands chronically inflamed.

PLATE XIII.

(From Luys-Wolbarst.—*Cystoscopy and Urethroscopy.*)

folds are correspondingly fewer, until in the highest grade of infiltration the folds have disappeared entirely and the urethra appears at the end of the urethroscope as a stiff, inelastic tube with smooth walls.

The shape of the central figure is changed into a star-shaped and lengthened funnel.

The above-described changes in the mucous membrane, which occur as a result of the hard infiltration, are also participated in by the urethral glands. Oberlaender divides hard infiltration as (*A*) *glandular form* and (*B*) *dry form.*

## LESIONS OF MORGAGNI'S CRYPTS AND LITTRÉ'S GLANDS

### Glandular Form and Dry Form

If the ducts of the glands remain open, the glands can discharge their contents. This is known as the glandular variety. If, however, the ducts are obliterated by compression of the surrounding structures or by the contraction of its own walls, the secretion is pent up and accumulates within the gland which is converted into a cyst. This is the follicular or dry form. The term "dry" is used only to describe the aspect of the surface of the mucous membrane, after it has been deprived of its glands; a purulent and persistent discharge always accompanies this condition.

**A. Urethroscopic Findings in the Glandular Form.**—As a result of the loss of the epithelium the ducts of *Littré's glands* become visible.

Lying in groups, they appear enlarged and surrounded by an inflammatory zone.

The openings sometimes appear like craters, and secretion is seen issuing from them.

*Morgagni's crypts* show similar changes, and their swollen and gaping openings, with mucopurulent secretion issuing from them. appear distinctly surrounded by infiltration.

When the periglandular infiltration is so strongly marked, the ducts of the glands are elevated above the surface and are seen as small, red protuberances.

**B. Urethroscopic Findings in the Dry or Follicular Form.**—From the compression of the scar-tissue forming the periglandular infiltration, the ducts of Littré's glands are closed and the glands themselves obliterated or transformed into subepithelial cystic cavities filled with colloid masses.

The ducts of Morgagni's crypts also become obliterated and t gland contents become inspissated and thickened.

Sometimes Morgagni's crypts and Littré's glands are transform into small cysts filled with pus, which may be found isolated or groups. Occasionally the cysts attain a considerable size and proj

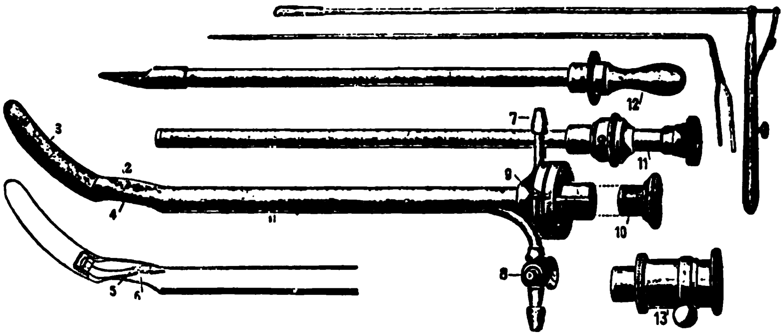

Fig. 42.—Wossidlo's irrigation urethroscope for the posterior urethra, with galvano-caustic point and brush for applications to the colliculus.

into the lumen of the urethra, or Littré's glands may be seen as sm tumors underneath the mucous membrane.

The proliferation of urethral epithelium and the connecti tissue infiltration, may be so great on the surface, that the glands at some little depth from the mucous membrane.

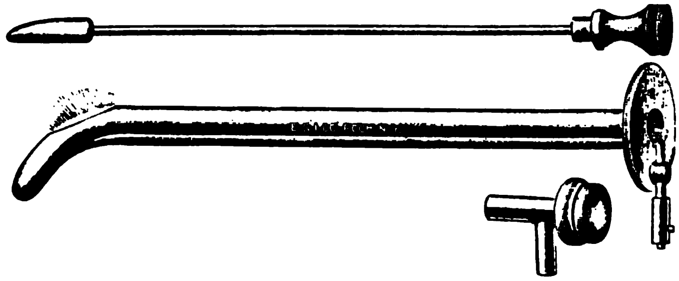

Fig. 43.—Swinburne's urethroscope for the posterior urethra.

These lesions are sometimes difficult to diagnose with the endosc but may be easily felt by palpation of the urethra over a metal sou

The urethroscopic picture of the *dry form of urethritis* is usu quite distinctive.

It is characterized by the fact that there are none at all, or v few, gland-duct openings visible.

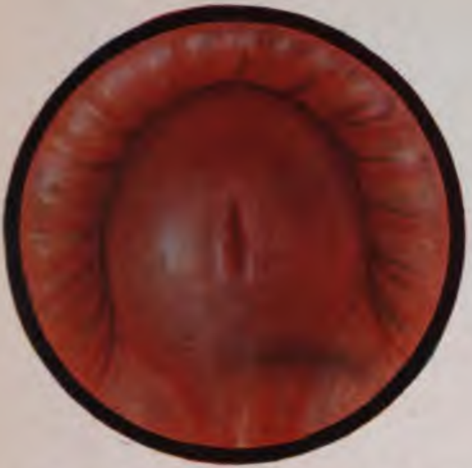

Fig. 1.—Normal appearance, anterior view of the verumontanum, in which the prostatic utricle is distinctly seen. The upper part of the urethral mucosa is finely corrugated and constitutes a valuable landmark in determining the shape and size of the verumontanum. This is the most common view observed.

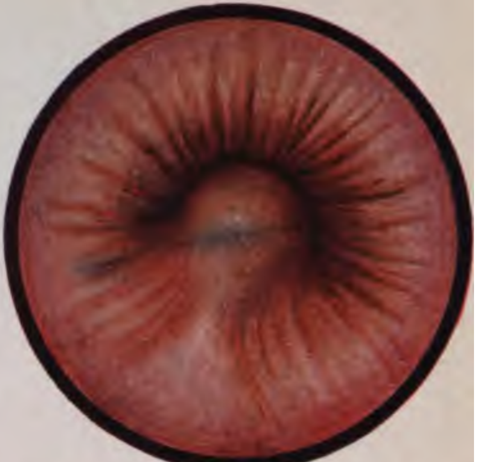

Fig. 2.—Normal appearance, anterior aspect of the verumontanum. The protrusion of the verumontanum has diminished in height and width; in front of the verumontanum, its frenum is clearly seen; above, on the roof, the corrugations have increased the thickness of the mucosa appreciably.

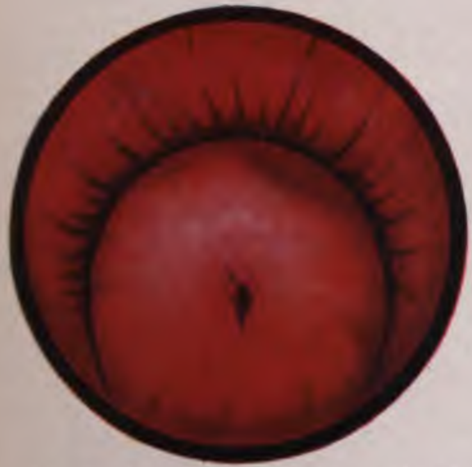

Fig. 3.—Appearance of a very considerably hypertrophied (masturbator's) verumontanum. The organ here takes on the appearance of the uterine neck.

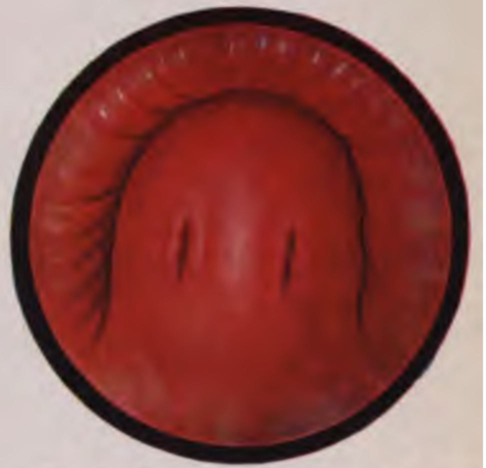

Fig. 4.—Normal appearance, anterior surface of the verumontanum. The prostatic utricle is not visible, but on the lateral walls of the verumontanum, two orifices are seen corresponding to the ejaculatory ducts (resembling a diver's helmet).

PLATE XIV.

(From Luys-Wolbarst.—*Cystoscopy and Urethroscopy.*)

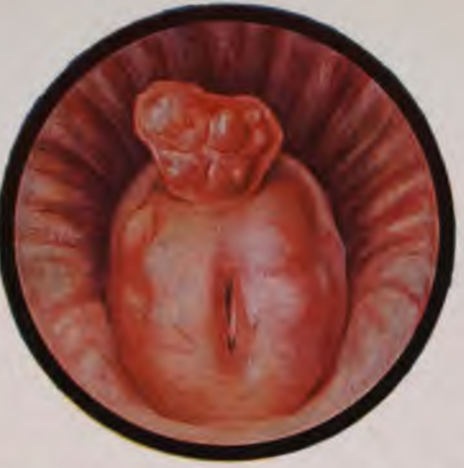

Fig. 1.—Little polypus situated on the apex of the verumontanum.

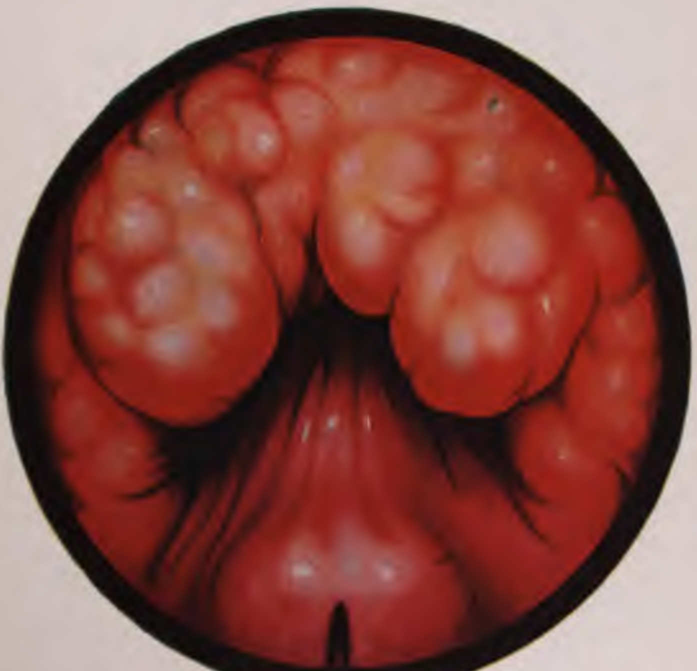

Fig. 2.—Glandular lesion of the anterior surface of the prostate, seen through the urethroscope.

PLATE XV.

(From Luys-Wolbarst.—*Cystoscopy and Urethroscopy.*)

Here and there may be seen, at the location of a duct-mouth, a small white or yellow glistening prominence, which denotes the closed follicle, which can be felt as a hard nodule the size of a millet seed by palpation over the urethra.

In proportion to the grade of the hard infiltration, the changes in the mucous membrane are more or less marked.

Longitudinal folds have more or less disappeared.

The *epithelium* appears, in this form, notably dull, without luster, and desquamates in large pieces and gives to the observer the impression of dryness.

Not infrequently both dry and glandular forms of infiltration are found side by side, and are described by Oberlaender as the ***mixed infiltration.***

## URETHROSCOPIC FINDINGS IN CHRONIC POSTERIOR URETHRITIS

The technic of posterior urethroscopy differs considerably from the examination of the anterior urethra.

The patient is placed in the lithotomy position, and, while the posterior urethra can be examined with the straight tubes used for the anterior urethra, the introduction past the cut-off muscle is somewhat difficult.

The best instrument for examining the posterior urethra is the recently devised water endoscope of Wossidlo or Goldschmidt, and with these instruments a wonderfully clear and magnified picture of the urethra is obtained. The colliculus can be closely examined, polypi detected, and even the orifices of the ejaculatory and prostatic ducts may often be seen.

The author regards these only as instruments for diagnosis, however, and for making applications prefers a curved posterior urethroscope, with a movable light and without the water attachment devised by Dr. Geo. K. Swinburne, of New York.

The same pathologic alterations which have been described in the anterior urethra also occur in the posterior urethra, and can be detected with the urethroscope. One finds here, also, soft and hard infiltration, and the latter can be divided into various grades.

With the **soft infiltration** the mucous membrane is bright or bluish red in color, hyperemic and bleeds on the lightest contact.

It is swollen to a considerable degree and shows small closely packed edematous bulgings, which bleed as soon as they are touched.

The prostatic glands are often affected. They are red, swollen, and encircled by a prominent edge, which have been compared b Goldschmidt to frogs' eyes.

In certain cases, they form small apposed purulent masses resembling small white buttons.

The lesions of chronic prostatitis may be located behind the verumontanum and on the lower wall and are also found on the uppe surface of the urethra and in the grooves on either side of the verumontanum.

The verumontanum is swollen and enlarged, and projects upwar into the tube. Its surface is either smooth or lumpy and furrowe and often resembles a raspberry and distinct polypi are frequentl seen projecting from it.

The utricle is sometimes involved and pus may occasionally b noted issuing from its mouth.

The openings of the prostatic sinuses are generally not visible o account of the swelling.

The mouths of the ejaculatory and prostatic ducts show, when th are visible, swollen walls and gaping orifices.

The **hard form of infiltration** gives changes analogous to tho described as occurring in the anterior urethra, although, on account the absence of visible glands, they are more uniform and resemb more the dry form of the hard infiltration.

The mucous membrane appears pale red or grayish yellow in col and dry and lusterless.

If the verumontanum has been attacked by the connective-tiss infiltration, it is yellowish in color, with a dulled epithelial luster, a is flattened and smooth on the surface.

In high degrees of hard infiltration, one finds horizontal, thre like scars, and the parts of the mucous membrane lying above th are dry and grayish yellow in color.

## UNUSUAL CONDITIONS OBSERVED WITH THE URETHROSCOPE

In addition to the changes above described, which are commo met with, certain conditions are sometimes seen.

*Papillomata* resembling the vegetations occurring on the prep are occasionally found. They may fill the urethra to such an exten to interfere with urination; and if they occur in the posterior uret lead to marked reflex disturbances of the nervous system.

*Cysts* formed by the retention of secretion in the urethral gland

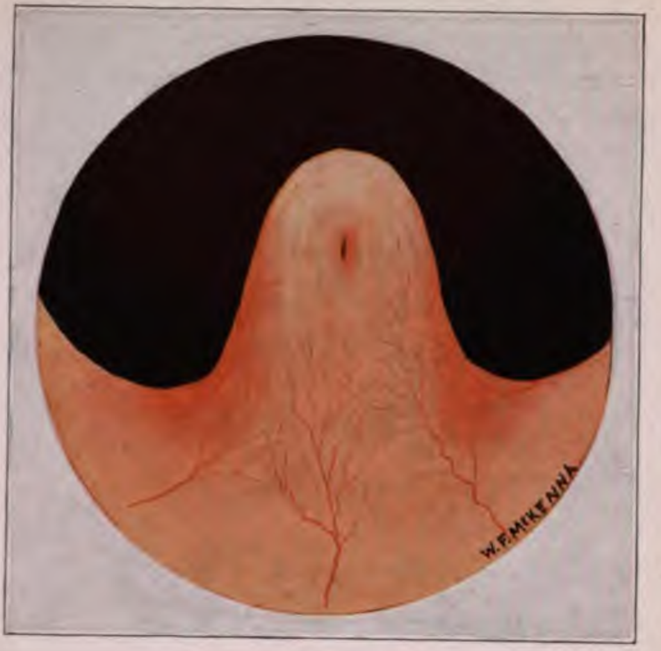

Fig. 1.—Normal colliculus.

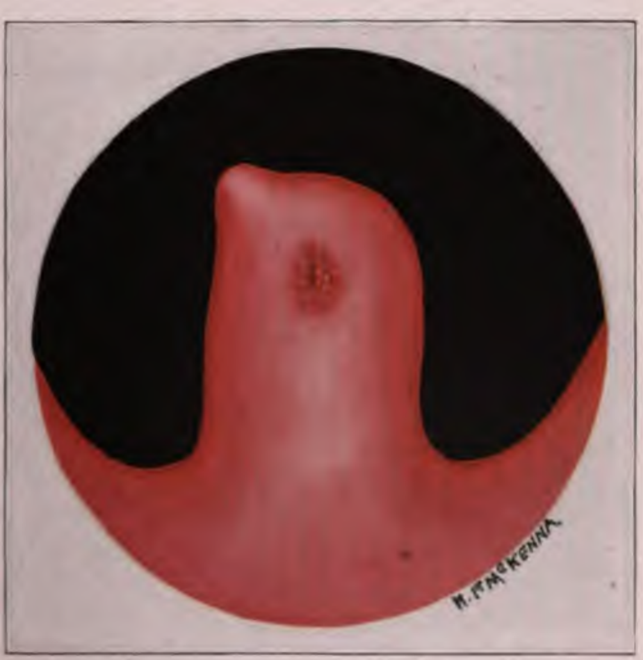

Fig. 2.—Inflamed colliculus. Papilloma at apex and granulations around utricle.

PLATE XVI.

Cowper's glands have been observed by Fenwick, Grünfeld, and others. They are of extreme rarity.

*Psoriasis mucosæ* is observed as snow-white spots, not elevated above the surface, and formed of masses of pavement epithelium closely adhering together.

Changes of color sometimes result from the frequent use of nitrate of silver, and appear most often as bluish black spots, in the vicinity of the gland openings, or even sometimes as extensive spots of discolored mucous membrane.

## TREATMENT OF THE ANTERIOR URETHRA

The urethroscope is a useful instrument for diagnosis, but is of little value in the treatment of chronic urethritis, for, while granulations and erosions may be cauterized through the endoscopic tube, the submucous infiltration upon which they depend can not be reached by a superficial application, but requires the pressure of dilatations to cause its disappearance.

The application of remedies is made to the diseased surface by means of a tampon of cotton wrapped around a stick[1] and introduced through the endoscopic tube. The principal *drugs* in use are: nitrate of silver, from 10 to 100 grains to the ounce; iodine and carbolic acid, equal parts; sulphate of copper, 25, 50, or 100 grains to the ounce, and bichloride of mercury, in 1 per cent alcoholic solution.

The intervals of treatment depend upon the amount of reaction; every three days for mild solutions and from five to seven days for strong ones are about the average. After improvement begins intervals should be increased to ten days. The first application should always be mild; 10 grains to the ounce is strong enough to begin with, and it may be increased later if desired.

In regard to the selection of the appropriate remedy, it may be said in a general way that a diffuse hyperemia calls for milder solutions of nitrate of silver: 5 or 10 grains to the ounce. Granulations require strong solutions of nitrate of silver, from 50 to 100 grains, or carbolized iodine. For erosions mild solution of nitrate of silver, 5 or 10 grains to the ounce, is the best, while for inflamed glands carbolized iodine answers well.

Sometimes a localized area of granulations in the bulbous region may cause a continuance of the discharge, and in these cases, which do not clear up after dilatation, topical applications through the endoscope of a 10 to 20 per cent nitrate-of-silver solution rapidly destroy the granulations.

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[1] The sticks which florists use for tying on to the ends of cut flowers answer the purpose.

Morgagni's crypts are often the seat of a chronic inflammation, and afford opportunity for the growth of colonies of gonococci, which cause relapses of an apparently cured gonorrhea. They can be disposed of like any other suppurating sinus, by destroying them with the galvanocaustic needle, through the urethroscope under the guidance of the eye.

Papillomata of the urethra can be removed by a wire loop or destroyed by electrolysis.

In the **posterior urethra** local treatment through the endoscope is often indispensable.

The prostatic urethra requires the strongest applications of nitrate of silver; but under inspection, if the lesions do not improve, the strength of the solutions can be increased or their character changed, as occasion requires.

In chronic posterior urethritis, with a good deal of inflammatory swelling of the verumontanum, cauterizing it with a 20 per cent nitrate-of-silver solution (100 grains to the ounce), as advised by Burckhardt and Wossidlo, often gives brilliant results, and the various reflex nervous disturbances disappear very rapidly.

Tincture of iodine may be used as an absorbent, and when the nitrate of silver causes excessive pain Frank advises the use of trichloracetic acid, 5 or 10 per cent, as a caustic, and in very resistant cases burning the calliculus with the red-hot galvanocaustic point usually results in a cure.

Geraghty describes a chronic infective inflammation of the prostatic utricle, causing frequent relapses of a posterior urethritis which was cured by injecting the utricle with a 5- to 15- grain nitrate-of-silver solution, once a week, for a few times.

### BIBLIOGRAPHY

Braasch, W. F.: Pyelography, 1915.
Cabot and Young: Boston Med. and Surg. Jour., Oct., 1911.
Casper, L.: Cystoscopy, 1898.
Casper and Richter: Functional Diagnosis of Kidney Diseases, translated by Robert C. Bryan, 1903.
Croftan, A. C.: Urinology, 1904.
De Keersmaecker: Chronic Urethritis, 1901.
Geraghty and Rowntree: Jour. Pharmacology, July, 1910.
Lewis, B., and Mark, A. G.: Cystoscopy, 1915.
Luys, Georges: Cystoscopy and Urethroscopy, 1918.
Oberlaender: Lehrbuch der Urethroscopie, 1893.
Purdy: Uranalysis, 1895.
Rieder: Urinary Sediments, 1899.
Rumpel, O.: Cystoscopy, 1909.
Ultzmann, Robert: Pyuria, 1884.
Voelcker, F.: Chromocystoscopy, 1906.
Wossidlo: Gonorrhoe, 1909.

# CHAPTER VIII

## URINARY FEVER, OR UROSEPSIS

Urinary fever is the most important postoperative complication which the genitourinary surgeon is called upon to treat, and by far the largest proportion of patients who die after operations on the prostate, bladder, or kidneys perish as a result of this condition.

The element of nervous shock attendant upon instrumentation of the urethra and bladder was formerly thought to be responsible for the clinical manifestations, but urinary fever is generally regarded at the present time as an *infectious disease* which is brought about by the entrance of pathogenic organisms into the blood circulation, through wounds or lacerations of the urethra or bladder. Among various other organisms the colon bacillus plays an important part in the causation of urinary fever. Microorganisms and their toxins may be brought into the blood circulation in various ways.

The sound or catheter may be dirty and infected with germs which are introduced into an accidental laceration made in the mucous membrane by the instrument. With the present methods of asepsis, this is unusual and the organisms are generally already in the urogenital tract. The normal urethra is probably fairly sterile, but in the dilated pouch behind every stricture numerous organisms are always present, and in every case of cystitis and pyelitis the urine contains numbers of germs.

After a solution of continuity, made either by an accidental traumatism or by an operation wound, a gateway is opened for the entrance of organisms and their toxins into the blood current.

The *course of the fever* depends upon the size of the wound and the quantity of microorganisms absorbed. If a small amount of septic material is taken up in oft-repeated doses, the fever runs a chronic course.

In case the kidneys were diseased and incapable of eliminating waste products completely before the onset of the fever, the attack is more severe, inasmuch as the kidneys fail to excrete the products of nitrogenous waste and, in addition, can not clear the blood of the accumulated toxins.

Clinically three forms of urinary fever are observed:

## ACUTE TRANSITORY URINARY FEVER

Shortly after instrumentation of the urethra or bladder—*i. e.*, passing sounds, dilatation, urethrotomy, or cystoscopy—a chill occurs, lasting half an hour or more and followed by fever, and the urinary secretion is lessened or entirely suppressed. After a few hours the temperature falls, with profuse sweating; the kidneys begin to secrete freely again, and the urine contains abundant urates and sometimes albumin.

It was such cases as these that gave rise to the opinion that the phenomena were due to nervous shock from the instrumentation, but, as the chill never follows the instrumentation immediately, but always several hours later, and usually after the patient has voided his urine, it is reasonable to exclude the element of nervous disturbance and regard the symptoms as due to absorption.

In strong, healthy men with sound kidneys the symptoms described above need cause no anxiety. The attack is transient and lasts only a few hours, and after three days the feeling of prostration passes off and the patient is none the worse for his experience.

In order to lessen the chance of urinary fever certain conditions are necessary:

I. Healthy kidneys. As already stated, imperfect elimination of urea predisposes strongly to urinary fever; hence it is important to ascertain that the kidneys are healthy before operating on the urethra.

II. Complete asepsis of instruments and genitourinary tract It is easier to secure asepsis of instruments (see section on care o instruments) than to sterilize the genitourinary tract. A good dea can be accomplished in that direction by irrigations of the bladder and urethra, before instrumentation, with oxycyanide-of-mercury solution 1:4000.

The urine should be sterilized by the administration by the mouth of salol, gr. x, three times a day, or urotropin, gr. xx, three times day.

III. All instrumentation should be made with the utmost gentleness, to avoid causing lacerations. By avoiding any tearing of th mucous membrane there is no opportunity for microorganisms t make their way into the blood current and so excite the fever.

### Treatment of the Attack

As already stated, after the chill the fever soon subsides, when th patient breaks out into a very profuse sweat, and the indication therefore, is to encourage free perspiration by putting the patient to bed, surrounding him with hot bottles, and giving a hot drink.

Phenacetin is useful for the headache, and a saline cathartic should be given the next day to complete elimination of the toxin.

## CHRONIC URINARY FEVER

**The chronic form** may follow an acute attack. The temperature, instead of becoming normal with a profuse diaphoresis, remains slightly elevated in the morning, with a pronounced evening rise, and the fever is of the remittent type. After lasting five or six days, the fever breaks up, with a free sweating.

Another form which chiefly affects old men suffering from chronic retention of urine begins very insidiously. The temperature is only slightly elevated in the evening, but the patient is not aware that he has fever, and may go on for weeks before the thermometer is used and discloses a rise.

He usually consults a physician on account of digestive disturbances, complaining of dry tongue, want of appetite, and difficulty of digestion; vomiting or diarrhea is often present.

There are always mental symptoms, dull headache, confusion of mind, and at night, when the temperature is elevated, mild delirium and moderate sweating.

The patient emaciates slowly, the skin appears dry and wrinkled and of a yellowish-white color, and only after a number of weeks is the cachexia well established. With an elderly man complaining of such indefinite symptoms, a urinary examination will always show marked changes.

The urine contains pus in considerable quantities, usually more albumin than would be accounted for by the pus, indicating involvement of the kidney parenchyma. The specific gravity is usually low, and the reaction is often alkaline and the odor frequently ammoniacal, or distinctly fecal if colon infection is present and the phenolsulphonephthalein and other tests show markedly deficient activity in the secreting function of the kidneys.

In these cases of chronic urinary fever a severe cystitis is always present, and most frequently a secondary ascending infection of the kidneys has taken place, with a pyelitis or pyelonephritis.

The symptoms of toxemia are due to the absorption of bacteria and toxins, in small quantities and for a long-continued time and the retention of waste products in the blood which the damaged kidneys are unable to excrete.

In such a condition as described any operative interference, such as prostatectomy or crushing a stone in the bladder, or even reckless catheterization, is fraught with great danger to the life of the patient.

The crippled kidneys cease their function entirely, and the patient dies of *septic anuria.*

### Treatment

The first indication is to provide free drainage for the bladder, and so prevent any further absorption.

This may be accomplished by gradually emptying the bladder with a catheter if it be overdistended. This requires about a week and should be accomplished by drawing off a small quantity of urine several times a day. After the bladder has been emptied, a permanent catheter may be worn and the bladder irrigated with silver nitrate solution, 1:4000.

If the conditions are so threatening that a radical procedure must be adopted at once, a rapid perineal section or suprapubic cystotomy under cocaine will serve to drain the bladder and stop further absorption.

The second indication is to assist the kidneys in their efforts to eliminate the toxins. This can best be accomplished by causing the patient to drink large quantities of pure water.

Colonic irrigation by the drop method (Murphy drip) may be required in the grave cases.

The urinary antiseptics, urotropin and salol, are always indicated to disinfect as much as possible the kidneys and bladder, and fre catharsis must be used, to clear out the large intestine.

## ACUTE SEPTIC ANURIA

Acute septic anuria is the most common and from its fatalit the most dreaded of all postoperative complications of the genito urinary organs.

No matter how complete the asepsis has been on the part of th surgeon or what efforts have been made to accomplish the impossib and sterilize the urine and genitourinary tract, before the operatio a certain number of patients, particularly old men, will die from th cause.

Probably in every such fatal case the kidneys will be found autopsy to be the seat of a pyelitis or nephritis, and the arteries be more or less atheromatous, while in younger men a history of co stant alcoholism will be obtained.

The operation may be so slight as passing a catheter on an old m with a large prostate and drawing off a considerable quantity of residual urine, or the condition may follow a more severe procedure, such as an external urethrotomy for stricture, a litholapaxy for stone in the bladder, or a prostatectomy.

The clinical picture is distinct; shortly after an operation, a slight chill and moderate rise of temperature will be noted.

Delirium is present, either dull and muttering or wild and maniacal. The tongue is characteristic and is dry and brown, with fissures. On palpation of the abdomen it is found markedly distended and tympanitic. Even these unfavorable symptoms may subside if the kidney secretion is free, but unfortunately the kidneys are, as a rule, damaged, and, moreover, are afflicted directly by the toxins, and they are unable to eliminate the poison circulating in the blood.

The urinary secretion is always scanty and loaded with pus. Colon bacilli or other organisms are frequently present.

As the case goes on unfavorably, the kidney secretion becomes more and more scanty, the pulse and respirations grow more rapid, and death takes place, apparently from an overwhelming of the entire nervous and eliminative systems by the poison.

The exitus lethalis may be looked for in from four to seven days, unless an improvement occurs, in which case the kidney secretion is reestablished by degrees, the abdomen becomes soft, the delirium improves, and the temperature becomes normal. As long as the kidneys are free from disease septic anuria is a rare postoperative complication, but unfortunately the kidneys become affected in most cases of disease of the bladder and urethra of long standing.

To give a correct prognosis in cases where operation is projected, careful preliminary examinations of the urine may lead us to give a guarded prognosis where kidney disease is found. It is here that the great practical importance of the tests of kidney function come into play, for if the phthalein, indigo-carmine or phloridzin tests show deficient secreting power on the part of the kidneys, any operation must be deferred until the kidney function has been improved. By means of preliminary prophylactic treatment before operation, much can be accomplished to lessen the risk of death following an operation on the urinary tract.

A bladder which has been overdistended with residual urine for a long time should never be emptied at one sitting, nor should an immediate prostatectomy be attempted, but the patient should be kept in bed, the bladder gradually emptied, and finally a permanent catheter worn for some days, until the fever has subsided and the patient feels well. The bladder should be irrigated, the bowels kept freely opened to prevent accumulation of colon bacilli, and the kidneys induced to act by insisting on the patient's drinking large quantities of water. The urinary antiseptics, urotropin and salol, are also indicated.

The above treatment is equally called for in cases of stone in the bladder. In stricture, unfortunately, it can only be partially carried out, as it is usually impossible to introduce a catheter to keep the bladder empty.

### Treatment of the Attack

The essential point in the treatment is to get the kidneys secreting freely and for this purpose the best diuretic is water introduced in large quantities into the system.

It is our practice to begin treatment by *hypodermoclysis,* using 1000 c.c. of normal saline solution to which 150 c.c. of a 5 per cent solution of glucose has been added, in the cellular tissue under the breasts or thighs.

This may be used several times in the day, if needed, or in desperate cases a smaller quantity may be given by intravenous injection

It is our practice to give the hypodermoclysis immediately after the operation is completed in cases where we fear trouble with the kidneys and we have noted that the procedure seems to lessen the postoperative shock and assist the kidney secretion to become free earlier than in cases where it is not used.

The next best method of getting water into the circulation is by means of the Murphy drip or normal salt solution delivered drop by drop from an irrigator through a soft rubber catheter carried high up into the rectum, by which it is absorbed, and this metho should be used continuously in all cases where the kidneys nee stimulating.

If the patient is not vomiting everything, water should be freel given by the mouth; if the vomiting is continuous and of a blac color, the stomach should be washed.

If the tympanites is moderate, turpentine stupes to the abdome and enemata of sweet oil, ℥ii, turpentine ʒiv and soap suds, and th retention of a rectal tube often causes a discharge of the flatus.

If tympanites does not yield, the stomach should be washed eve if there is no vomiting, and six ounces of ice water left in it at th completion of the washing to start the peristaltic action, and followe immediately by high colonic irrigation.

The drugs which are employed in this condition are eserine an strychnine of each gr. 1/40 given hypodermically every two hou for three doses and asafetida in 5-grain pills, every three hours. Pituitrin, 1 ampule, injected every four hours hypodermically and calomel gr. x, Jalap gr. xx, and sodii bicarb., gr. xxx, should be given by mouth.

Suppression of urine more or less complete always accompanies the tympanitic distention of the abdomen and must be treated by the application of the electric baker or hot packs.

Diuretin gr. v or x every four hours may be used and if the Murphy drip is not absorbed the vessels must be filled by hypodermoclysis or intravenous saline injections.

If urine is retained in the bladder, as in a case of enlarged prostate, at the beginning of catheter life, the bladder should be kept empty by means of a permanent catheter and washed twice daily with silver-nitrate solution, 1:4000. If the colon bacillus is the active agent in causing the cystitis, colon vaccines should be administered hypodermatically.

Any operation wounds should be opened up freely and irrigated frequently.

## CARE OF URETHRAL INSTRUMENTS

All the instruments which are used in the urethra should be perfectly smooth and highly polished, since any roughness upon the surface will abrade the delicate mucous membrane and expose the patient to the dangers of septic absorption and urinary fever. Instruments should also be well lubricated before introduction. Vaselin is most commonly employed, but it has the disadvantage of coating the mucous membrane and preventing its contact with the irrigating solutions used afterward. Any lubricant should be kept in and used from the flexible tubes, which protect it from the air and keep it sterile.

An excellent lubricant is prepared according to the following formula, suggested by Casper:

| | | | |
|---|---|---|---|
| ℞ Hydrarg. oxycyanide | Grams | 0.246 | (gr. iiiss). |
| Glycerin | | 20. | (f℥ss). |
| Tragacanth | | 3. | (gr. xlvj). |
| Aq. destillat. | | 100. | (f3iij). |

This should be put up in tubes and remains sterile.

It is a good lubricant for all urethral instruments, and may be used in preferencce to glycerin for lubricating the cystoscope before introduction, as it washes off the lamp and window after the cystoscope has entered the bladder.

It is unfortunately impossible to rid the urethra completely of organisms before introducing instruments, but a considerable amount of sterilization can be accomplished by irrigating the urethra with a 1:4000 oxycyanide-of-mercury solution before instrumentation. After the operation of passing sounds or using a cystoscope is finished, another irrigation of the urethra and bladder with oxycyanide should also be made. After a cystoscopy it is always useful to irrigate the bladder through a catheter with 1:1000 solution of nitrate of silver, to destroy any organisms which may have been accidentally introduced.

With regard to the care of the instruments themselves, several large books have been written on the best ways of sterilizing them, but for everyday practical use in the office or dispensary the following methods, which are at present generally in use in genitourinary clinics, will be found to meet the requirements:

*Sounds* and *urethroscopic tubes* should be kept in a drawer and prevented from knocking against each other, which destroys the polish. After using, they should be washed in hot water with soap and a brush, and boiled for five minutes in a solution of washing soda (ʒiiss to Oij). The soda is added to prevent rusting. Lithotrites, tunneled sounds, urethrotomes, and metal catheters may be treated in the same way. Soft-rubber catheters should be washed off outside and running water allowed to flow through them; but this is not enough for disinfection, and, in order to accomplish this, they must be boiled in plain water afterwards.

*Cystoscopes* can not be boiled, as the cement holding the lamp in place is destroyed; but, according to Casper, they may be completely sterilized by rubbing for two minutes with two or three cloths we with tincture of green soap, paying particular attention to the joint about the lamp and prism. They should be rubbed afterward wit alcohol ether to remove the green soap.

The movable parts of the catheterizing cystoscope may be boile for five minutes.

Before using they may be immersed for a few minutes in solutio of formalin, 2½ per cent, or in lysol.

*Silk-web catheters, urethral or ureteral,* after being used in case which are not very septic, should be rubbed outside with tincture o green soap, to remove the adherent lubricant or secretions, and washe with soap and water. The lumen should be treated by syringin through with oxycyanide of mercury, 1:4000, and then hung up a night to drain and dry. In the morning they should be placed i a jar containing a formalin tablet.

The woven-silk catheters which were formerly made were spoiled by boiling, but various improvements in the manufacture now make it possible to boil them twenty or thirty times before they become too soft to use.

Catheters which were used in very septic cases should be sterilized by wrapping each one separately in gauze, and boiling three minutes in a saturated solution of ammonium sulphate, not allowing them to come in contact with each other or the bottom of the vessel. After boiling they should be taken out and laid away to cool off and become hard.

Instead of being boiled in sulphate-of-ammonium solution, they last longer if they are treated by wrapping in gauze separately and placed in the boiler above the level of the water and steamed for five minutes. Extreme care must be exercised in boiling woven silk catheters as boiling softens the varnish and it cracks if another instrument rests upon it or if it is bent before it has cooled. To avoid cracking the varnish it must lie perfectly straight in the boiler, not touching the ends and no other instrument must rest upon it.

After it has been boiled it must not be touched until it has been cooled by lifting it from the water or pouring in cold sterile water.

In a clinic where many catheters are used, they can be sterilized in quantities, by placing them in the steam sterilizer, which is a part of the outfit of every hospital operating room; after being wrapped in gauze and after steaming they can be laid away, wrapped up in filter-paper and ready for use.

*Flexible bougies à boule*, after using, should be washed off with soap and water, or rubbed off with benzine or alcohol ether, sterilized by rubbing off with oxycyanide solution, and laid on a cloth for some hours to become thoroughly dry.

They may also be steamed five minutes, but become softened in time.

They should be kept in a jar containing a formalin tablet.

*Kollmann's irrigating dilators,* after using, are washed off with soap and water and a brush, and steamed in a special steam pot, or boiled for five minutes and then dipped in alcohol to prevent the joints from rusting.

*Rubber dilator covers* are rubbed off with benzine or alcohol ether to remove the grease, then wrapped in gauze and steamed for five minutes. If placed in the boiler they should be kept above the water level, as boiling softens them.

*Glass irrigator nozzles* should be boiled and kept immersed in solution of oxycyanide of mercury.

*Knives* with fine, delicate edges are dulled by boiling, but may be sterilized by placing in alcohol or formalin solution, 2½ per cent.

*Whalebone guides* are spoiled by boiling or soaking in a solution. After using, they should be rubbed off with benzine or alcohol ether and oxycyanide solution, and kept in a jar containing a formalin tablet.

# CHAPTER IX

## ANATOMY OF THE URETHRA

The urethra is an S-shaped canal, whose walls lie in wrinkled folds and come closely in contact, except when distended by the passage of urine or a catheter.

The length of the canal from meatus urinarius to sphincter vesicæ is about eight inches and it is divided into three regions:

(*a*) The anterior or pendulous urethra, which is six inches in length.

(*b*) The membranous urethra, which is about one inch long.

(*c*) The prostatic, or posterior, urethra, which is one inch in length.

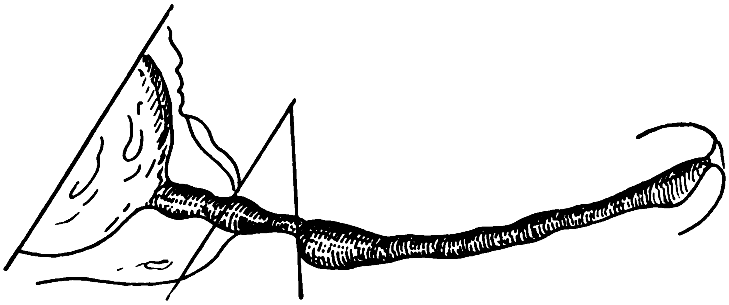

Fig. 44.– Wax cast of the normal urethra, showing its points of narrowing and dilatation.

**The anterior urethra** is surrounded by the erectile tissue of the corpus spongiosum, which terminates in the bulb. At a point corresponding to the bulb, in the anterior urethra, and lying between the penoscrotal junction and the anterior layer of the subpubic triangular ligament, for a distance of an inch, is a part of the canal which is termed the *bulbous urethra.*

**The membranous urethra** is the portion of the canal lying between the anterior and posterior layers of the triangular ligament. Its mucous membrane is not so richly supplied with mucous glands and follicles as the other portions of the urethra, and it acts as a barrier to the onward progress of a gonorrheal inflammation.

The membranous urethra is surrounded by bands of voluntary muscular fibers known as the **cut-off muscle,** or *compressor urethræ,* which is normally in a state of tonic contraction, and acts as a valve to separate the anterior from the posterior urethra.

Before the act of urination the cut-off muscle is relaxed in orde

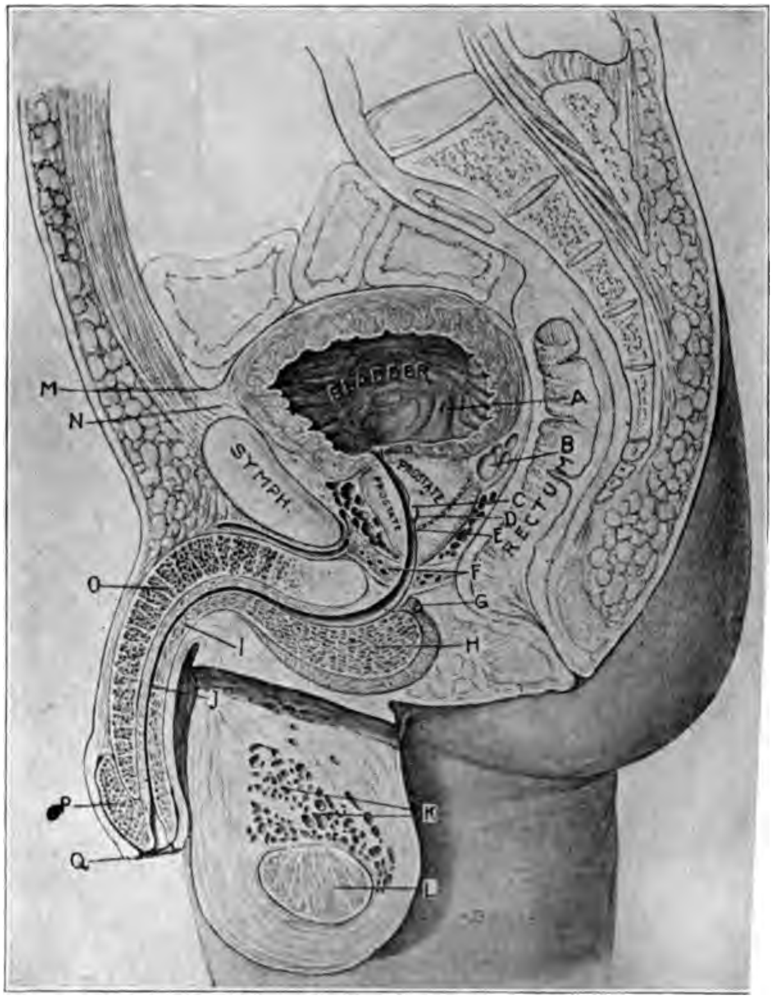

Fig. 45.—Section through bladder, urethra, and testicle. *A*, urethral orifice; *B*, se vesicle; *C*, colliculus seminalis or verumontanum; *D*, prostatic utricle; *E*, orifice of ej tory duct; *F*, suspensory ligament; *G*, Cowper's gland; *H*, bulb of corpus spongiosu corpus spongiosum; *J*, urethra; *K*, seminal plexus; *L*, testicle; *M*, peritoneal fold; *N*, of Retzius; *O*, corpus avernosum; *P*, glans penis; *Q*, prepuce.

to allow the urine to flow out past it, and by its voluntary con tion the flow of urine can be instantly shut off.

The cut-off muscle is sometimes affected by a cramp-like con tion and fails to relax, causing retention of urine or rendering it difficult or impossible to pass a sound. This condition is known as spasmodic stricture.

**The prostatic,** or **posterior, urethra** perferates the prostate gland. It is very richly supplied with mucous glands and follicles. Upon its floor is a small elevation composed of erectile tissue and abundantly supplied with nerves, and called the **colliculus seminalis, verumontanum,** or caput gallinaginis.

On the anterior aspect of the colliculus is a slit-like orifice, which leads into a *cul-de-sac* within its substance—the **prostatic utriculus.**

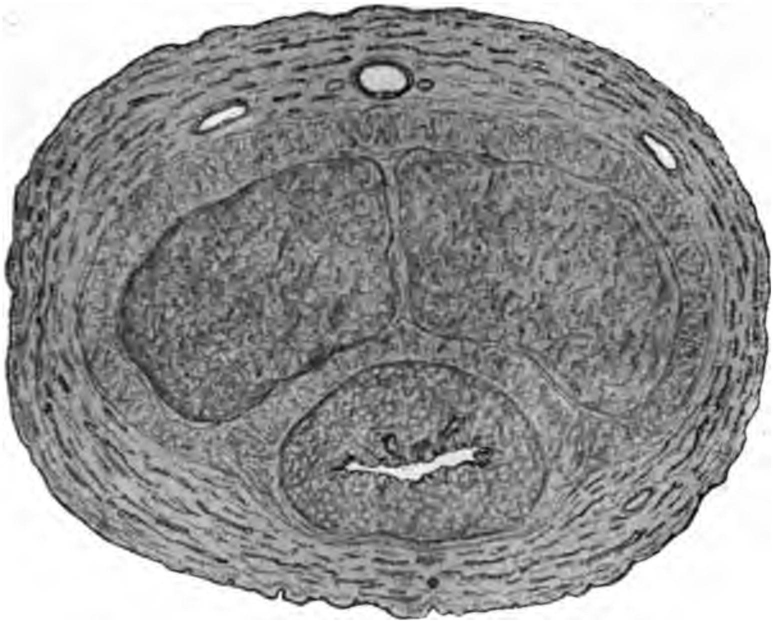

Fig. 46.—Section through corpora cavernosa and corpus spongiosum, showing urethra and Littré's glands.

On the lateral margins of the utricle or it may be just within them are the minute openings of the *ejaculatory ducts.*

On either side of the colliculus is a longitudinal groove called the *prostatic sinus* into which the majority of the prostatic ducts open.

The prostatic ducts are usually twelve in number but may be twenty or thirty, and while those from the lateral lobes of the prostate empty at the sides of the verumontanum a few of the ducts from the middle lobe empty in the median line between the verumontanum and the bladder.

The urethra is not like a tube of uniform caliber, but is a canal

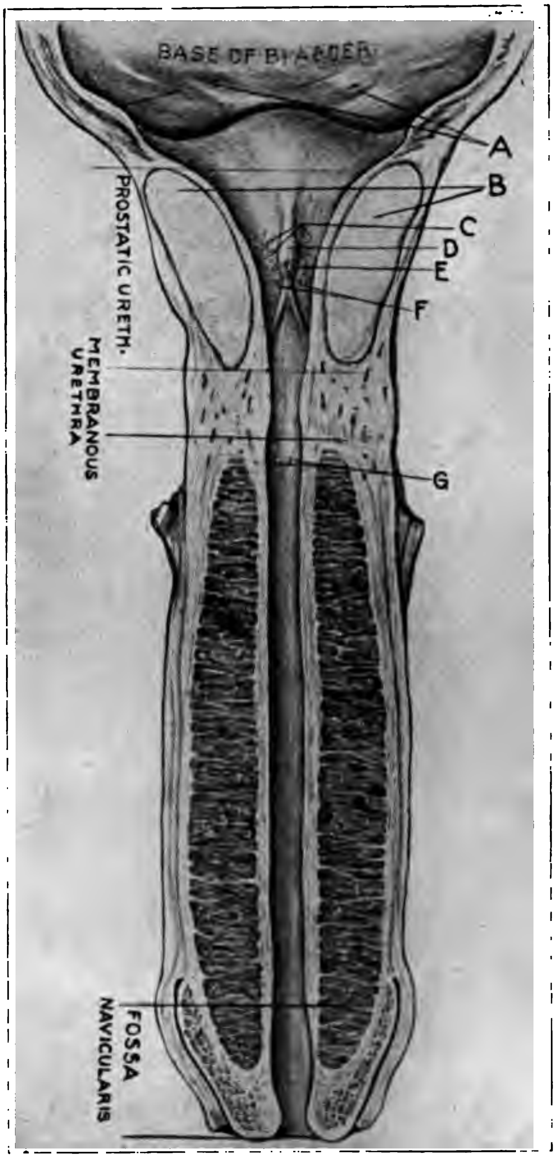

Fig. 47.—Bladder and urethra laid open to show the floor. *A*, ureteral ori prostate; *C*, prostatic ducts; *D*, colliculus seminalis or verumontanum; *E*, prostatic *F*, ejaculatory ducts; *G*, ducts of Cowper's gland.

of varying width and distensibility. There are three points of p **logic narrowing**:-

I. At the meatus.

II. Somewhere in the third inch.

III. The membranous urethra, lying between the anterior and posterior layers of the triangular ligament.

The points of **widening** which are susceptible of instrumental dilatation to a considerable extent are as follows:—

**I. The fossa navicularis,** which is located just within the meatus, and contains in its roof a large mucous crypt, known as the lacuna magna. Guerin's fold is located at its posterior margin.

**II. The bulbous urethra,** which lies just in front of the triangular ligament and extends for one and one-half inches. It is the widest and most dilatable part of the anterior urethra, and contains the orifices of the ducts from Cowper's glands.

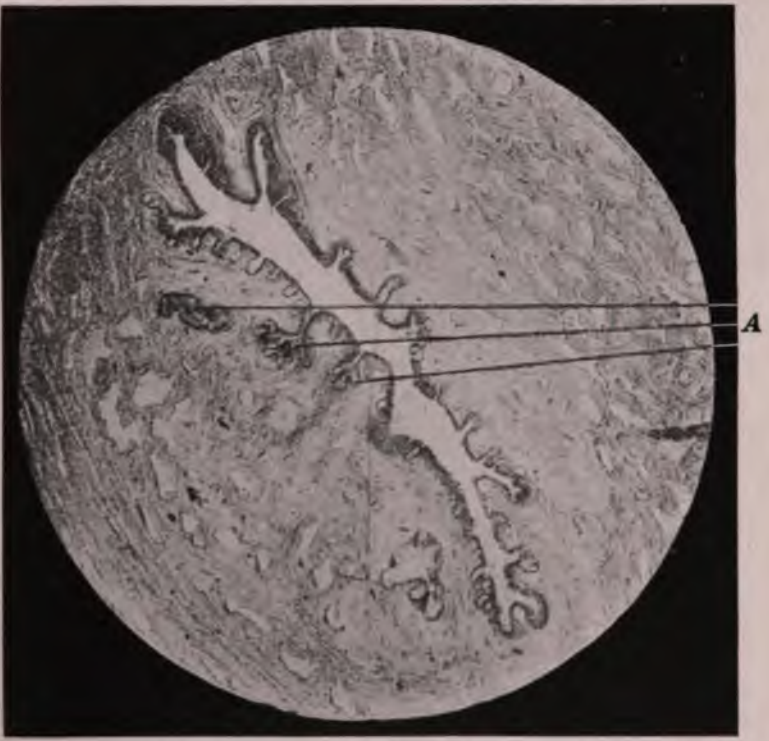

Fig. 48.—Cross section of urethra, showing Littré's glands. *A*, glands of Littré.

**III. The prostatic urethra,** usually termed the posterior urethra, is capable of greater distention than any other portion of the urethral canal, and may be dilated to 40 or 45 of the French scale without injury.

**The mucous membrane** which lines the anterior and membranous urethra is soft, delicate, and easily lacerated, and is composed throughout its entire length, excepting the fossa navicularis, of epithelial cells of the *cylindrical* variety.

The epithelium lining the prostate urethra is of the transitional variety, the deepest layer being formed of cylindrical cells, while above these is a layer of polygonal or irregular-shaped cells, and the most superficial layer is composed of several strata of large, flattened cells. This same variety of epithelium is formed in the pelvis of the kidney, ureter, and bladder.

The mucous membrane throughout the urethra is richly supplied with glands and follicles.

**The glands of Littré** lie beneath the mucous membrane in the meshes of the corpus spongiosum and are true glands, lined with secreting epithelium and provided with a duct which empties upon the free surface of the urethral mucous membrane. They are very numerous, and are arranged in groups together.

**The follicles of Morgagni** are simple crypts or depressions of the urethral mucous membrane, and are located upon the roof of the canal.

# CHAPTER X

# DISEASES OF THE PENIS

## PHIMOSIS

By the term phimosis is understood an abnormal narrowing of the opening of the prepuce, which prevents the retraction of the foreskin and causes the glans penis to be permanently covered.

Phimosis may be *congenital* or may be *acquired* in adult life.

In nearly all male children at birth the foreskin is long and is adherent to the glans. In early life these adhesions are very weak and are easily ruptured by erections of the penis or manipulation, and in the course of the first few years the preputial orifice becomes enlarged and the prepuce can be stripped back over the glans. If the adhesions are not ruptured early, they become firmer as they grow older, and prevent the complete retraction of the foreskin.

The *acquired* form of phimosis occurs in adults, and often results from the cicatricial contraction of the margin of the prepuce following the healing of a chancroid in this location.

Temporary phimosis often results from the swelling and edema of the prepuce which occurs in the course of an attack of gonorrhea or subpreputial chancroids.

As **direct results of phimosis** the following conditions are met with:

(*a*) *Balanitis and venereal warts,* resulting from the maceration of the epithelium in the balanopreputial sac, from retention of smegma and urine. On account of the difficulty of retracting the prepuce proper cleanliness can not be observed, and the tender mucous membrane is especially liable to persistent and recurrent attacks of inflammation. Proliferation of the epithelial cells occurs, and venereal warts grow luxuriantly.

(*b*) *Preputial calculi,* or concretions, form not infrequently, from a calcification of the smegma and the decomposition of the urinary salts.

(*c*) *Epithelioma of the penis* is strongly predisposed to by the continued irritation of the foreskin and retention of the secretions under it.

(*d*) *Arrested development of the penis* usually occurs in consequence of the malnutrition from which the organ suffers.

(*e*) *Premature erections and sexual excitement* are generally noted in young children affected with phimosis, and the continued irritation about the head of the penis often establishes a habit of *masturbation.*

(*f*) *Interference with the act of coitus,* often accompanied by premature ejaculation, is frequently complained of by adults affected with phimosis.

(*g*) *Liability to infection with syphilis or chancroidal poison* is invariably the case when the prepuce is long, even though it can be retracted, and Hutchinson points out that the circumcised Jew is less liable to contract syphilis than an uncircumcised person, because after circumcision the integument of the glans becomes horny, and is not liable to abrasions.

The **remote results** of phimosis are equally important, and often present great difficulties in the exact determination of their origin.

(*a*) *Retention or incontinence of urine,* especially in children, but sometimes in adults, is often caused by a spasmodic contraction of the cut-off muscle or an irritable bladder, induced by the irritation about the glans penis.

(*b*) *Hemorrhoids, prolapsus ani, hernia, and dilatation of the ureters and kidney pelves* often follow the prolonged and violent straining efforts which individuals affected with phimosis make, upon urinating, in order to overcome the resistance offered by a spasmodic stricture or a pinpoint opening through the prepuce. The susceptibl nervous system of children renders them particularly liable to th above-mentioned difficulties and also to the following affections:

(*c*) *Affections of the nervous system,*—spastic palsies, simulate hip-joint disease, muscular incoordination, and convulsions,—whic are often observed in young children as reflexes from a tight or adherent prepuce, and a disappearance of these symptoms often follow circumcision.

(*d*) *Herpes preputialis* is another manifestation of the reflex action upon the nervous system and skin of the prepuce occasioned b the irritation of a long foreskin, even though it is possible to retrac it over the glans.

## Treatment

On account of the manifold advantages offered by an absence the foreskin, it would be well if Christian nations were to adopt t old Hebrew rite of circumcising all male children on the eighth da after birth. In this operation the foreskin is simply snipped off wit one sweep of a knife, and the wound washed with a weak astringe antiseptic. The pain is slight, and an anesthetic is not required, n would it be safe to administer one, in so young a child. Hemorrhage is trifling, and there is but little risk of infection afterward.

Stripping back the foreskin and breaking up the adhesions is sometimes recommended, but is a very poor makeshift for circumcision, and there is always the danger of the prepuce being caught back behind the glans, and becoming swollen and constricted, causing *paraphimosis.*

Circumcision is the operation of choice, and may be performed in two ways:

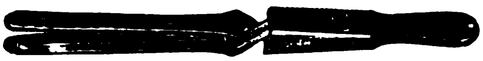

Fig. 49.—Clamp for circumcision.

(*a*) **Circumcision with a Clamp.**—In this operation the clamp is applied to the foreskin immediately below the glans penis, and all the prepuce which projects beyond the clamp is severed with a knife or scissors. This incision simply cuts through the skin alone, and the mucous membrane lying next the glans is left intact and must next be trimmed off with the scissors. After this is done the cut edges of skin and mucous membrane are stitched together with interrupted sutures of catgut, and the operation is completed.

There are certain objections to this procedure. In applying the clamp, if too much traction is made on the foreskin, the skin of the proximal end retracts close up to the root of the penis after the incision is made, and leaves a gaping raw surface of mucous membrane to be covered. On the other hand, if too much foreskin is left, the glans remains covered by it and the object for which the operation was performed is not accomplished. Even when the incision is properly made the subsequent adjustment of skin and mucous membrane often induces a certain amount of tension and dragging upon the sutures, which interferes with the healing of the wound.

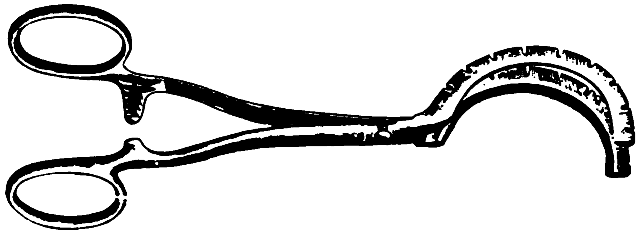

Fig. 50.—Beard's clamp for circumcision

(*b*) **Circumcision by Dorsal Incision and Trimming off the**

**Flaps.**—The surgeon stands upon the patient's left side and with a pair of straight scissors makes an incision on the dorsum of the prepuce, cutting through skin and mucous membrane at the same time. The incision is carried up to the point three-eighths of an inch from where the mucous membrane is reflected upon the glans penis. A grooved director may be introduced under the foreskin if desired, to act as a guide for the scissors.

After the dorsal incision is made the two remaining flaps of skin and mucous membrane are trimmed off with curved scissors. This incision is carried around the penis on both sides, following the line of insertion of the mucous membrane at a distance of three-eighths of an inch from the glans.

The frenum is divided last, and its artery, together with the dorsal artery, and sometimes one or two smaller ones, are picked up and tied, and the sutures are introduced.

It is desirable to place the first suture on the dorsum of the penis, and the second suture stitches the remains of the frenum to the point of skin underneath it. These anchor the skin and prevent it from shifting, as it lies on the mucous membrane. The other sutures are then introduced, and usually three on a side will be found enough. Fine catgut is the best material, as it is absorbed, while if silk sutures are used much trouble is experienced in removing them.

The best form of dressing seems to be a piece of lint wet with an antiseptic solution and changed frequently, as any sort of permanent dressing is soon soaked with urine. The patient should remain quietly in bed or on a lounge, for a week, and may be then allowed to go about as usual.

Very recently a new form of operation has been devised with **Beard's clamp,** which has certain advantages.

By means of this clamp the flaps can be trimmed off even, and Schleich's infiltration of cocaine can be used as local anesthesia.

TECHNIC.—A 2 per cent novocaine solution is injected along the dorsum of the penis, and a dorsal incision through the skin and mucous membrane is made with scissors.

The flap thus formed is grasped with the clamp and cocaine injected along its outer edge.

The flap is then trimmed off with scissors, using the edge of the clamp as a guide.

The sutures are inserted through the skin and mucous membrane the notches in the clamp serving as guides for placing them.

The clamp is then removed and the opposite side treated in th same way.

With regard to the anesthetic employed, some surgeons use cocaine or novocaine injection by Schleich's infiltration method.

The objection to cocaine injected hypodermatically in the older operations of circumcision with a clamp or by dorsal incision is, that the skin shrinks so much under the effect of the cocaine that landmarks are obliterated and the surgeon is apt to cut off too much skin and mucous membrane. The edema of the cellular tissue resulting from tying a rubber bandage around the root of the penis to prevent the too rapid absorption of the cocaine interferes with the healing of the wound afterward.

These objections seem to be removed by using Beard's clamp, and it would seem as though it might be a valuable adjunct in the operation.

On account of the objections to the use of cocaine, the author prefers to use a general anesthetic, and nitrous oxide is well adapted to the purpose.

## HYPOSPADIAS

Hypospadias is the most frequent malformation occurring in the penis, Rennes finding it once in every 300 French army recruits.

The deformity often exerts a depressing psychical influence on the individual's mind; the garments are soiled with urine, there is difficulty in expelling the stream of urine, and in doing so the patient assumes the squatting posture.

The scrotum, constantly wet with urine, becomes eczematous, and coitus is often difficult on account of the incurvation of the penis.

Fecundation is nearly always impossible, and in 100 cases of married hypospadiacs examined by Beck none were found to have children.

The forms in which hypospadias occurs are described by Treves as follows:

1. The balanitic opening is at the side of the corona, the frenum is absent, and a hoodlike prepuce exists.
2. The penile urethra may open at any part of the under surface of the penis, and if the opening be far back nearly the whole of the penile urethra is absent so far as its floor is concerned.
3. Scrotal hypospadias.—Here the opening is at the junction of the penis and scrotum, or is on the perineal side of the scrotum.

In most cases the penis is small and deformed, and is held in a curved position by the rudimentary urethra on its under surface.

The operations of Dupuytren and Thiersch are best adapted to scrotal and marked examples of penile hypospadias.

In these operations a new canal is made by dissecting up flaps on either side of the penis and building from them a new urethra, around a sound, which serves as a mold.

While the technic of these operations is not especially difficult, the subsequent healing is interfered with by the leakage of urine, with infection of the stitch wounds, and primary union is the exception.

## Beck's Operation[1]

Beck's operation is based on the fact of the extraordinary distensibility of the urethra, which can be utilized for restoring either penile or balanic hypospadias.

Instead of forming a new urethra, the existing one is utilized by dissecting it free and dislocating it forward. As time elapses after the operation, the urethra becomes more elongated and adapts itself to the new position.

If the case is left untreated until adult life, the penis becomes short, wasted, curved, and often can not be straightened.

It would naturally be supposed that, during erection after an operation, the short urethra would draw down the glans and a curvature of the penis would follow.

Beck's experience, however, in a number of cases shows that this does not follow, particularly when the operation is performed in childhood.

TECHNIC.—A soft-rubber catheter or steel sound is introduced into the urethra, and an incision is made through the skin and fascia from the abnormal opening backward to the posterior third of the pendulous urethra.

A transverse incision is then made through the skin in the coronary sulcus, thus freeing the upper angles of the wound.

The urethra is then dissected in its whole length from its bed in the corpora cavernosa. The hemorrhage is but trifling.

The next step of the operation consists in forming a bed in the glans to receive the end of the loosened urethra.

(*a*) This may be done in two ways. The first method, which in general is to be preferred, is by forming two flaps, by making lateral incisions alongside of the groove in the glans. The end of the urethra is then placed in the wound-bed, covered with the flaps, and held in place with catgut sutures. (Figs. 51 and 52.)

(*b*) By the other method the glans is tunneled, by thrusting a narrow-bladed, straight bistoury through it from below upward. The

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[1] New York Med. Jour., December 8, 1900.

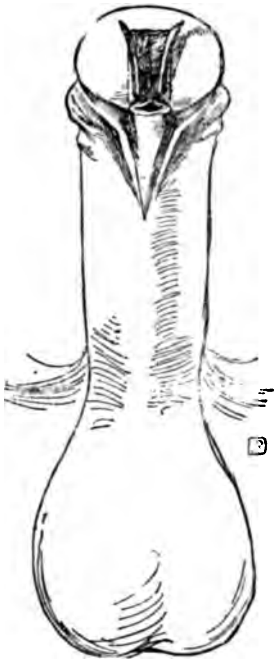

Fig 51.

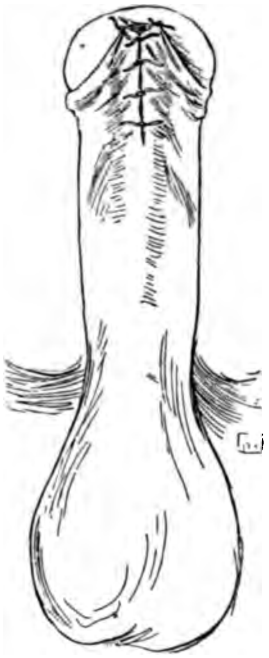

Fig. 52.

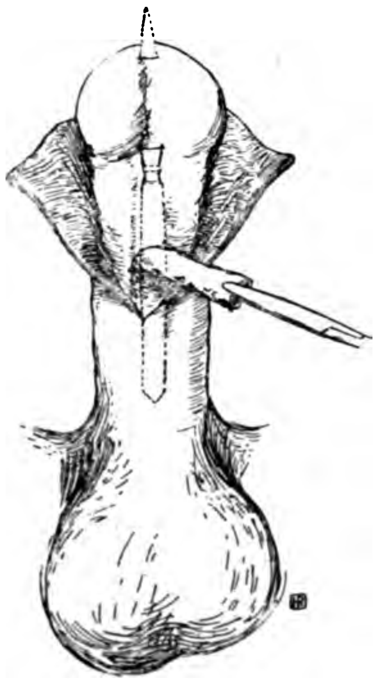

Fig. 53.

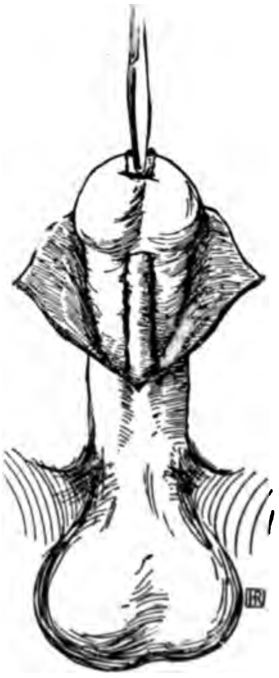

Fig. 54.

incision is enlarged sufficiently so that the urethra can be drawn through it by means of a long, narrow forceps, and held in place by four catgut sutures. (Figs. 53 and 54.)

Any operation for the relief of hypospadias should be done before puberty and contact of the urine with the fresh operative wound be prevented by providing suprapubic or perineal drainage of the bladder at the time of operation. Unless this is done, the operation frequently fails. (Haynes.)

The after-treatment is very simple, and consists in bandaging the penis in iodoform gauze and keeping a wet dressing over the newly formed orifice.

In adults, after an operation, especially in the case of a penile hypospadias, a slight incurvation is noted during erections.

This is best treated by the introduction of large metal sounds, which are allowed to remain in place for a time. If the incurvation becomes considerable, longitudinal incisions are made alongside the urethra into the penis.

## STRICTURE OF THE MEATUS

The meatus differs very much in size. Usually it is large enough to admit a 28 or 30 sound, but often it is so small that only a 22 sound can be introduced, or it may even be pinpoint in size. Narrow meatus is usually a congenital deformity, but it sometimes occurs as a consequence of cicatricial contraction following a chancroid of the meatus.

### Symptoms

Narrow meatus often gives rise to no symptoms and does not in itself require treatment. Not infrequently, however, it prevents a complete emptying of the urethra, during urination; a few drops o urine remain behind in the fossa navicularis, decompose, and caus a chronic inflammation of the mucous membrane.

The inflammatory process acts in a reflex way, inducing a spas modic contraction of the cut-off muscle, with permanent or occasiona retention of urine.

In cases of chronic urethritis, the presence of a narrow meatu interferes with the proper drainage of the urethra, and the irritatio of the decomposing urine prevents the postgonorrheal lesions fro healing. Some of these cases are cured by doing a meatotomy.

In every case where instrumentation of the urethra or bladder i required, as in litholapaxy, cystoscopy, urethroscopy, or sounding, i the meatus is too small to admit the instrument, it must be incise

It is bad surgery to attempt to force an instrument through a narrow meatus; the pain caused is excessive and the meatus is liable to be torn, while the operation of **meatotomy** is very slight and without risk.

### Technic

A rubber band is tied around the penis, to serve as a tourniquet.

A few drops of a 2 per cent solution of novocaine are injected hypodermically into the frenum and the meatus incised with a straight, blunt-pointed bistoury *on its floor,* sufficiently to admit a bulbous bougie, No. 30 French.

The fresh wound may then be stuffed with Schleich's glutol, a bandage applied, and the patient allowed to go about.

The patient should be instructed to pass a meatus sound three times a day, until the wound is healed. If this is not done, the cut surfaces will adhere and the opening close.

In very rare cases a severe hemorrhage follows meatotomy, due to wounding the artery of the frenum.

If it is entirely severed, the artery retracts and closes; but if only partially cut through, it continues to bleed. The hemorrhage may be controlled by passing a catheter through the meatus and making counter-pressure by firm bandaging around the end of the penis.

## BALANOPOSTHITIS

Balanitis consists in an inflammation of the mucous membrane covering the glans penis, and an inflammation affecting the mucous layer of the prepuce is termed posthitis. The inflammation of both surfaces usually exists simultaneously, and should be considered together.

Balanoposthitis can not occur in an individual who has been circumcised, but the presence of a long and phimotic foreskin allows the retention of the natural secretion of smegma and a few drops of urine, which decompose and irritate the already macerated mucous membrane, lowering its power of resistance to germ infection.

Gouty and lithemic conditions and diabetes also render the patient extremely liable to develop inflammation of the mucous membrane underneath a long foreskin.

As a direct exciting cause it is probably necessary that microorganisms of some sort must be inoculated, and for this reason a balanoposthitis often develops from contact with irritating vaginal secretions in coitus or the accidental introduction of pyogenic organisms from contact with the hands or clothing.

Chancre, gonorrhea, and chancroid are apt to be complicated by balanoposthitis as a result of mixed infection, when they occur in an individual having a long foreskin.

### Symptoms and Course

A mild form of balanoposthitis is liable to occur at frequent intervals unless the man with a long foreskin attends with scrupulous care to drawing it back and washing it, and the preputial sac, at frequent intervals.

If this is not done, a sense of heat and itching is noticed at the end of the penis; the mucous membrane becomes hyperemic, infiltrated, and eroded, and a creamy-yellow, purulent discharge, with an extremely offensive odor, is secreted from the mucous membrane of the preputial sac.

In *severe* cases the excoriations are extensive and well marked and the inflammation and edema are extreme; so that the whole prepuce becomes swollen. In this condition *gangrene* of the foreskin, either in part or as a whole, not infrequently takes place. (See section on Erosive Gangrenous Balanitis.)

### Diagnosis

The diagnosis of balanoposthitis presents but little difficulty, when the foreskin can be retracted and the glans inspected; but when phimosis exists the diagnosis is often perplexing.

If a microscopic examination of the discharge fails to reveal gonococci, but discloses numerous staphylococci, gonorrhea may be excluded.

Chancroid may be diagnosed by inoculating some of the preputial discharge upon the patient's thigh, and, if other chancroids are caused, it is probable that the original sore was a chancroid, although it is possible to cause sores resembling chancroids by the inoculation of staphylococci.

Chancre can be excluded by the absence of an indurated mass under the prepuce and the lack of the characteristic enlargement in the inguinal glands.

Epithelioma is often difficult to differentiate from the chronic form of balanoposthitis which affects middle-aged men; but epithelioma does not respond to local treatment, while balanitis improves quickly. In cases of doubt it is always in order to excise a small portion of the prepuce and subject it to microscopic examination to determine the question.

### Treatment

The essential points in the treatment are to keep the *parts clean and dry*. These indications can be met in the following manner:

In the cases when the *prepuce can be retracted*, the balanopreputial sac should be washed out with a mild antiseptic solution, either bichloride (1 in 10,000 to 1 in 4000) or Thiersch's fluid. The parts should then be dried and covered with a dusting powder:

| | |
|---|---|
| ℞ Pulv. amyli, | |
| Pulv. zinci oxidi, | |
| Pulv. talci | āā ʒij. |

Or:

| | |
|---|---|
| ℞ Hydrarg. chlor. mite | gr. xxx. |
| Acidi borici | gr. xv. |
| Acidi salicylici | gr. v. |

In chronic cases, occurring in elderly men, subgallate of bismuth has a particularly good effect.

After applying the dusting powder the glans should be covered with a layer of cotton and the foreskin drawn forward into place. This dressing should be changed several times a day.

If the erosions are deep and extensive, their healing can be hastened by brushing them over with a 10 per cent nitrate-of-silver solution before applying the dusting powder.

When *phimosis* exists and the *foreskin can not be retracted*, a long flat-billed syringe should be used for washing out the balanopreputial sac, every few hours.

A few syringefuls of warm water and soap may be thrown in and followed by injecting bichloride solution (1 in 10,000) or Thiersch's fluid.

The edema and swelling of the parts may be mitigated by prolonged soaking in hot water.

If the balanitis occurs as a result of diabetes or a subpreputial chancroid, it may be necessary to relieve the tension by slitting up the prepuce on the dorsum in order to avert impending gangrene.

In all cases of chronic or relapsing balanoposthitis, in addition to local measures, attention should be directed to the diathetic conditions which prevent a permanent healing. If the individual is gouty or diabetic, a suitable regimen should be adopted, and the general health carefully looked after.

In obstinate cases of balanoposthitis, circumcision should be performed as soon as the acute symptoms have subsided. This is especially necessary in elderly men, who are at an age when epithelioma is liable to develop on the glans or under the prepuce from the prolonged irritation of the parts.

In diabetic patients the operation of circumcision should be avoided if possible and the danger of extensive gangrene following slight operations should be borne in mind. If any operative procedure is demanded, it is of the highest importance to get the patient's urine in good condition before operating.

## HERPES PROGENITALIS

This affection is characterized by the formation of groups of small vesicles upon an erythematous base and located on the skin or mucous surface of the prepuce.

The thin vesicles are easily ruptured, and leave small, round, shallow, punched-out ulcers, which heal spontaneously in a few days.

Unlike herpes zoster, herpes progenitalis is generally unaccompanied with pain. In exceptional cases, however, pain is felt, whic is neuralgic in character and precedes the appearance of the eruption

A urethral discharge is sometimes observed, and endoscopic examination shows a collection of vesicles located *within* the urethra.

Recurrence is a marked characteristic of herpes progenitalis, an it is the rule for patients to have several attacks a year.

Herpes is very frequently associated with chronic disease of th prostate or urethra.

### Etiology

Herpes progenitalis may be regarded as a reflex manifestation o some irritation of the nerves supplying the genitals, and is usuall due to balanoposthitis, excessive coitus, or a long prepuce. Gout and lithemic conditions are thought to predispose the patient to a tacks of herpes.

### Diagnosis

If the case is seen early, the appearance of the vesicles is unmi takable, and after they have ruptured the small, round, punched-o ulcers are quite characteristic.

The lymphatic glands in the groin are usually not affected, but i one case in ten the inguinal glands are said to be enlarged in a chai as in syphilis. (J. W. White.)

### Treatment

The herpetic lesions rapidly heal with cleanliness and the applic tion of a simple absorbent dusting powder. Recurrent herpes p genitalis, which almost always occurs in connection with a long foreskin, can only be prevented by the operation of circumcision.

## PAPILLOMATA

Papillomata occurring about the head of the penis are frequently termed *venereal warts*. They are sometimes spoken of as *condylomata,* which is manifestly incorrect, as true condylomata are a manifestation of syphilis, and the papillomata have no connection with syphilis, but are of purely local origin.

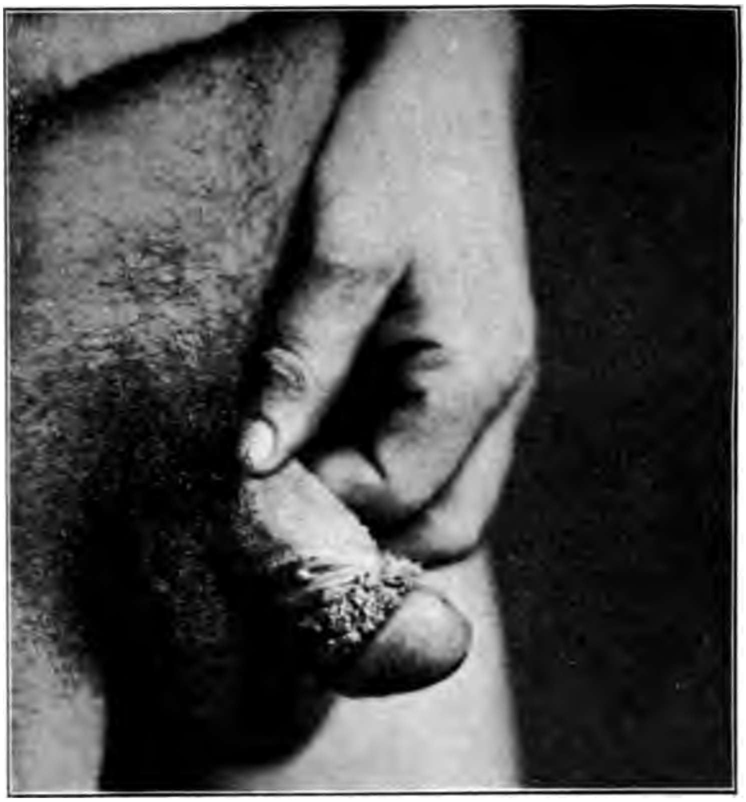

Fig. 55.—Papillomata—venereal warts. (Author's case, Kings County Hospital.)

Papillomata consist in warty growths, which are flat or often cauliflower-like excrescences, usually located in the coronary sulcus under a long prepuce. In structure they are a simple hypertrophy of the papillary layer, and are caused by the prolonged maceration and softening of the mucous surfaces under a long foreskin, occasioned by contact with irritating discharges from gonorrhea, chancroids, or balanoposthitis.

### Diagnosis

Papillomata may be mistaken for the condylomata of syphilis or epithelioma. In syphilitic condylomata, however, other signs of specific disease are always present; but epithelioma may be difficult to differentiate from simple papillomata, and every warty growth occurring about the glans penis in elderly men should be regarded with suspicion.

### Treatment

Small warts sometimes disappear if the parts are kept clean and covered with a dusting powder; but their disappearance is a matter of uncertainty, and always very slow. Operation is the best treatment, and should always be advised.

As papillomata occur in consequence of a long foreskin, circumcision should be performed, and the warts which are not removed with the prepuce scraped off with a sharp curette. In order to prevent a recurrence, it is desirable to cauterize the bases with nitric or carbolic acid or the Paquelin cautery.

## CANCER OF THE PENIS

Malignant disease of the penis occurs almost invariably as epithelial carcinoma, and begins with about equal frequency on the inner surface of the prepuce or upon the glans.

According to Jacobson, its mode of commencement is varied, but it appears most frequently as (*a*) *a wart,* or *warty excrescence.* Sometimes, however, it makes its appearance as (*b*) *a small nodule,* or *kno of induration,* under the surface of the mucous membrane.

Again, epithelioma is observed occurring under the form of (*c*) *superficial excoriation,* or *raw patch,* resembling the erosions found i balanoposthitis; or it may develop as (*d*) *an ulcer* resulting from th transformation of a chancroid or the breaking down of an old cicatrix or sometimes from a crack or tear on the margin of a tight foreskin

In cases of extreme rarity epithelioma of the penis develops fro the *extension of the malignant process* outward from the urethra o upward from the scrotum.

### Etiology

Under the head of predisposing causes *age* plays an importan rôle, and epithelioma of the penis is very rarely found except betwee the fiftieth and seventieth years.

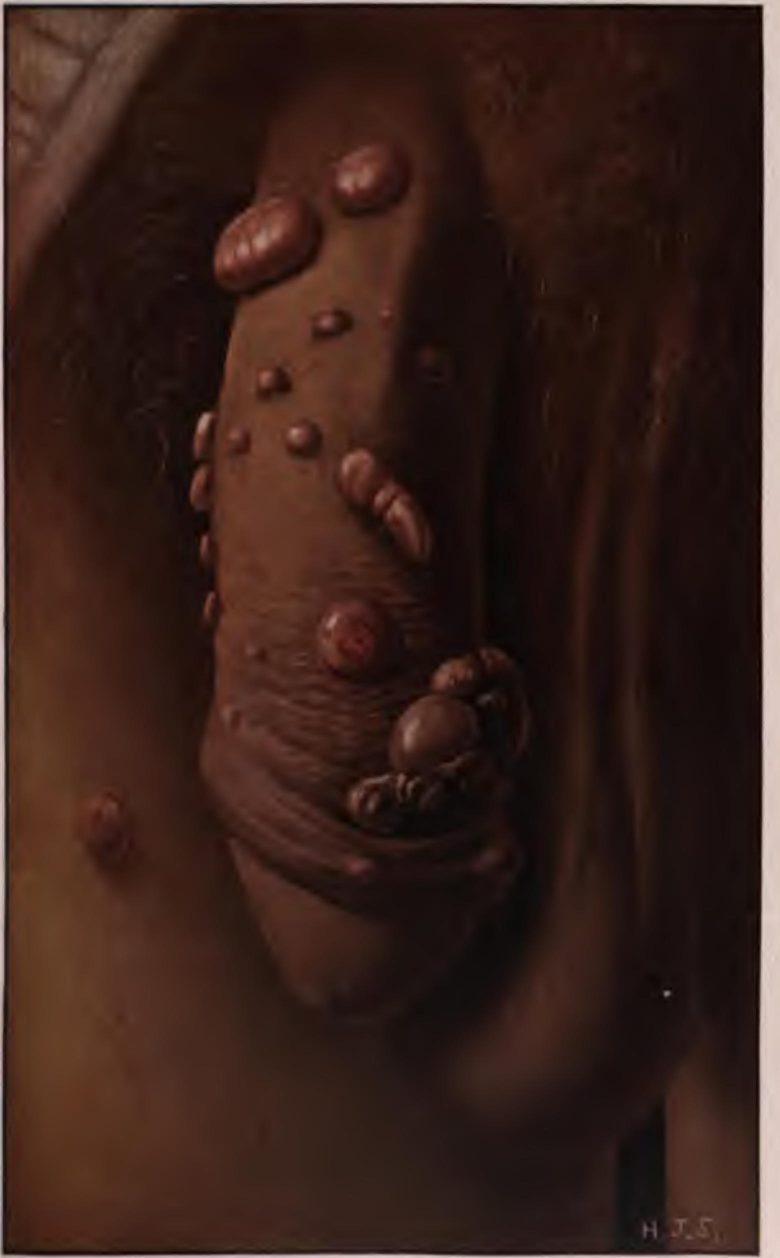

PLATE XVII.

Molluscum contagiosum of penis (nonspecific). (Author's case, Long Island College Hospital.)

## Course

No matter in what form the disease had its origin, its course is one of extension at the edges, accompanied by ulceration and breaking down in the older parts, and in most cases this is attended by the formation of large vegetations, or fungosities, resembling a cauliflower in shape.

A thin fluid, of a most disgusting odor, which dries into scabs, is continually secreted.

As the cancerous process extends only by continuity, its advance through the corpora cavernosa is not rapid, but the lymphatics readily take up the infectious material, carry it to the glands in the groin, and these are usually involved quite early in the disease.

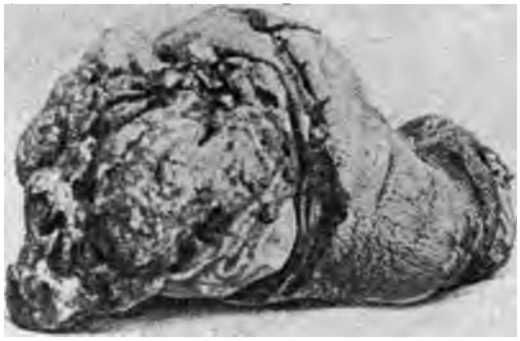

Fig. 57.—Carcinoma of penis. Amputation—a redundant prepuce removed by circumcision. (Author's case.)

The inguinal lymphatic glands are often the seat of a mixed infection, if pyogenic bacteria have been conveyed to them through the lymphatics and cause them to become inflamed and suppurate.

## Diagnosis

Every warty or papillomatous growth, or persistent erosion occurring on the glans penis, or inner surface of the prepuce, in an elderly person, should always be regarded with grave suspicion.

It is often difficult to differentiate simple papillomata or a chronic balanoposthitis from carcinoma, but the age of the patient, the long, protracted duration of the sore, together with a base which is hard, infiltrated, and immovable, and an edge which is hard and infiltrated, would point strongly in the direction of epithelial carcinoma. The diagnosis could be definitely determined by cutting a small piece from the growth and subjecting it to microscopic examination.

A gumma of the penis occurring in tertiary syphilis might be easily mistaken for epithelioma; but a few weeks' treatment with mercury and iodides would cause the gumma to disappear and the blood would show a positive Wassermann.

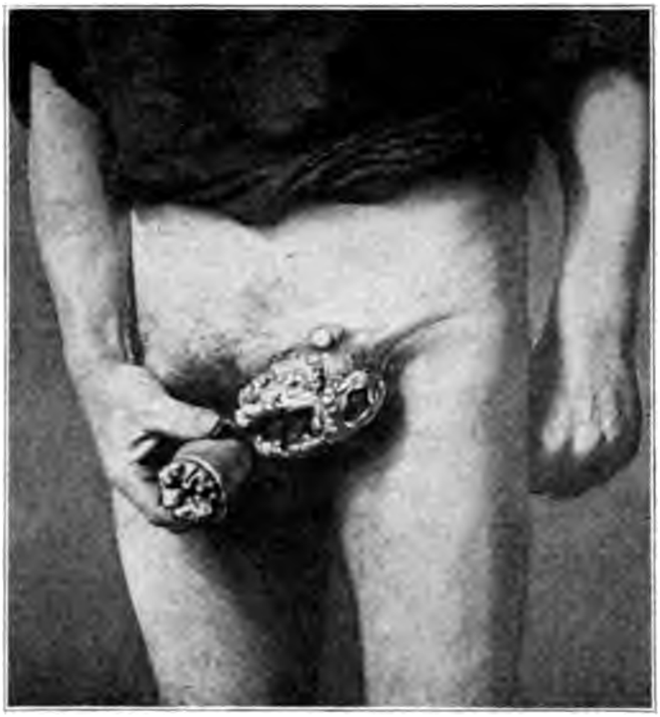

Fig. 58.—Neglected carcinoma of penis, with involvement of inguinal glands. (Author's case.)

## Prognosis

The prognosis of epithelioma of the penis is, of course, fatal without operation, and death occurs in from one to two years. If the disease is seen early and the growth removed by amputation of the penis and extirpation of the groin glands, the prognosis is good; but many cases come into the hands of the surgeon too late for a complete removal of all the foci of infection.. Winiwarter reports 12 amputations, of which 5 remained permanently well, 1 died of the operation, and 6 had recurrences, 3 of which were in the stump and 3 in the glands.

## Treatment

As already indicated, complete removal of all deposits at the earliest possible moment offers the patient the only opportunity of saving his life, and the application of caustics only excites greater activity in the growth and is a waste of valuable time.

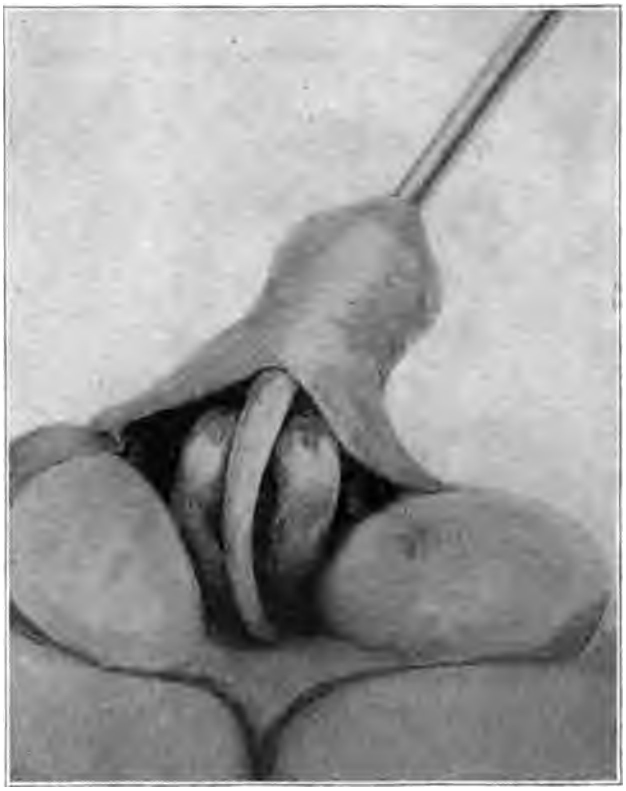

Fig. 59.—Incision dividing scrotum into two halves and exposing corpus spongiosum, urethra, corpora cavernosa, and triangular ligament.

Two forms of operation are in use, and a selection depends upon the extent to which the inguinal glands and corpora cavernosa are involved.

## Operations

**Amputation of the Free Portion of the Penis.**—TECHNIC.—A No. 20 French sound is introduced through the meatus into the bladder to indicate the position of the urethra.

A harelip-pin is thrust through both corpora cavernosa, at the root of the penis, to hold in place a rubber band, which is made to encircle the penis and act as a tourniquet.

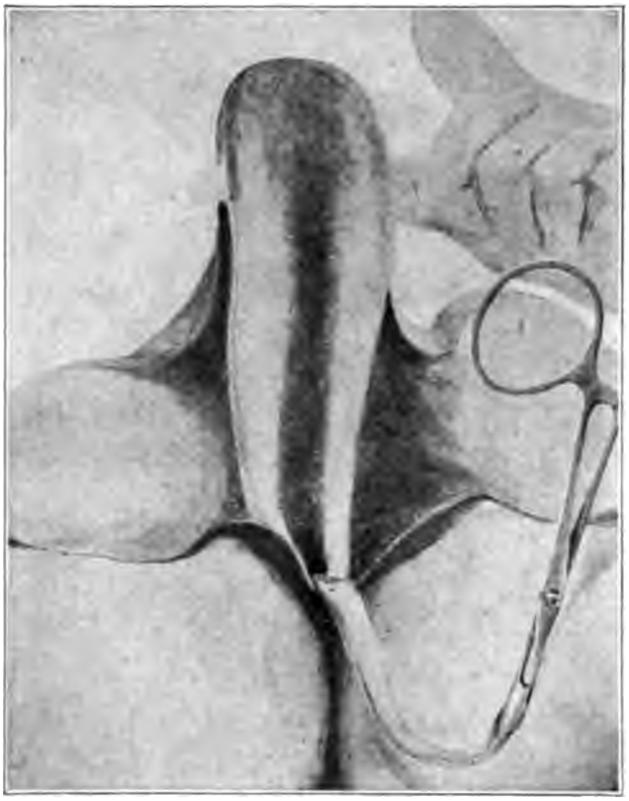

Fig. 60.—Corpus spongiosum containing urethra, dissected away from corpora cavernosa, cut through and hanging down at lower angle of the wound.

The skin of the penis is then cut through with a circular sweep of the knife, and turned back an inch. The corpora cavernosa are divided, down to the corpus spongiosum, which, with the urethra, is left to project like a spout for an inch, before being cut through.

The tourniquet is then unloosed and at least four arteries will require ligation. The skin flaps are sutured together, and the urethra stitched to the margins of the skin flaps.

A soft-rubber catheter is tied in the bladder to prevent the urine from infecting the fresh wound.

**Amputation of the Entire Penis.**—This is a much more serious operation than the former, but is demanded in the case of extensive infiltration of the corpora cavernosa with cancerous deposit.

Technic.—The patient is placed in the lithotomy position, and a sound is introduced through the urethra into the bladder. An incision is made along the raphé of the scrotum, splitting it into halves. The dissection is carried down so that the corpus spongiosum is seen perforating the triangular ligament, with the corpora cavernosa lying on either side and attached to the rami of the pubes. (Fig. 59.)

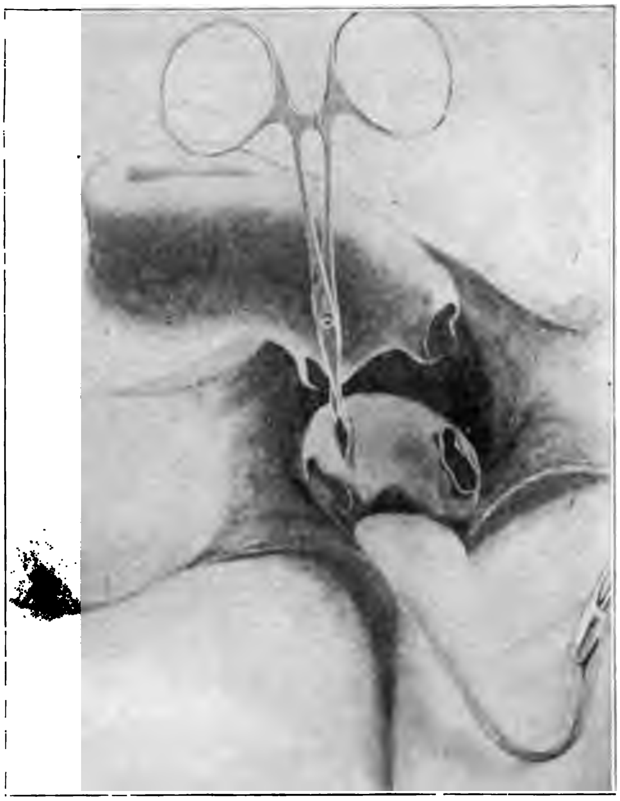

Fig. 61.—Charred stumps of corpora cavernosa after separation from pubes by burning through them with Paquelin cautery.

The corpus spongiosum, containing the urethra, is then dissected away from the corpora cavernosa for three inches, cut through, and allowed to hang down out of the way, at the lower angle of the wound. (Fig. 60.)

The next step is to separate the corpora cavernosa from their attachments to the rami of the pubes. It is generally recommended that this should be done with a periosteal elevator. The close attachment to the bones renders this a matter of considerable difficulty, and after separation there is a free hemorrhage, which is difficult to control.

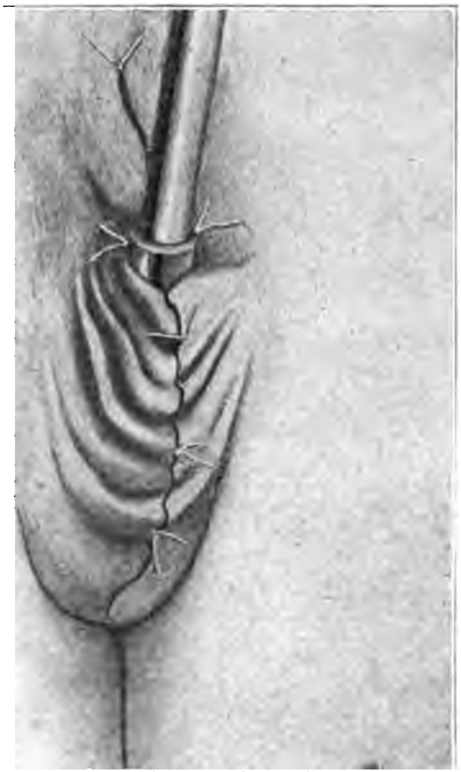

Fig. [illegible] Operation as completed. Urethra sutured into wound, with sound introduced through it.

The author prefers to burn through the crura penis, with a Paquelin cautery, close to their attachments to the bone, and in this way the corpora cavernosa are readily freed from the pubes and without hemorrhage (Fig. 61.) The Paquelin can also be used to stop bleeding, which generally occurs from the dorsal vessels of the penis under the symphysis pubis, at the upper angle of the wound.

The final steps of the operation consist in bringing the urethra up into the wound and stitching it to the margins of the skin-flaps, and then the skin on either side is brought into apposition and stitched, and a gauze drain is introduced along the under side of the urethra to the bottom of the wound. (Fig. 62.)

A catheter may be carried through the urethra and left in the bladder to drain it.

In this operation the testicles are exposed and may be left in the wound, or castration may be performed, to quell the sexual desire on the part of the patient after his recovery.

The inguinal lymphatic glands should be removed at the time any operation is performed for the relief of malignant disease of the penis, for if the glands have become infected, which occurs early in the disease, a recurrence of the cancer will inevitably take place later on.

# CHAPTER XI

## ACUTE URETHRITIS

ACUTE urethritis may be divided into **three varieties:**

(*a*) **An aseptic cartarrh,** in which no microorganisms are present and which is due entirely to irritation.

(b) **Nongonorrheal** or **bacterial urethritis,** which is occasioned by inoculation of the urethral mucous membrane with pyogenic bacteria (staphylococci, streptococci, bacterium coli, or pseudogonococci).

(*c*) **Specific** or **gonorrheal urethritis,** which is produced by the gonococcus of Neisser.

Among the **predisposing causes** to any variety of urethral inflammation may be mentioned a damaged condition of the urethra from previous disease which has left behind granulations, erosions, or a stricture; anatomic abnormalities, such as a long and narrow prepuce, a wide urethral orifice, and hypospadias; certain diathetic states, such as gout, rheumatism, and tuberculosis, which predispose to inflammation by lowering the resisting power of the body to bacterial invasion.

**An aseptic catarrh** of the urethral mucous membrane may be artificially caused by injecting the canal with a solution of nitrate of silver. The irritation and discharge last from twelve to forty-eight hours, and subside spontaneously.

The most ordinary example of this variety and the cases of gonorrhea in which the gonococci have disappeared but in which a discharge continues indefinitely maintained by the persistence in the use of irritating injections, which do not allow the postgonorrheal lesions to heal.

When the inflammation is due to this cause, it will cease after the patient has stopped using injections.

Another variety of the aseptic catarrh occurs in persons of a gouty diathesis, and may be designated as a *uric acid urethritis.*

It is a purely irritative inflammation, and is caused by the sharp points of the crystals when present in the urine in quantity. Under the administration of citrate of potash and large draughts of wa to neutralize the urine, it promptly disappears.

An aseptic urethritis frequently follows the unskilled injecti of solution of bichloride of mercury into the urethra, with the ject of preventing infection after coitus.

In another form of urethritis in which no organisms are fou the pathology is not clear. It is always caused by excessive ind gence in sexual intercourse accompanied by drinking. The incul tion period is from eight days to three weeks, and the discharge scanty and milky in appearance. If untreated these cases last definitely but yield promptly to irrigations of silver nitrate ur the urine is clear, when dilatation with sounds or Kollmann dilat should be used to complete the cure.

## NONGONORRHEAL OR BACTERIAL URETHRITIS

Any of the pus-producing bacteria—*i. e.,* staphylococcus, str tococcus, etc.—will excite a catarrhal inflammation, with suppu tion, of the mucous membrane, if introduced into the urethra. microorganisms may be introduced from without, through sex intercourse, and are contained in menstrual discharges, leucorrh secretions from an ulcerated cervix, and uterovaginal discharges any character. They may also be introduced upon a dirty sound catheter. On the other hand, the bacteria may lie dormant and suspected in the patient's own urethra, concealed in the crypts a follicles or submucous tissues, and may be lighted into activ through overindulgence in alcohol, intense erotic excitement, exc sive coitus, or traumatism produced by the passage of a sound.

After an attack of gonorrhea, a damaged condition of the uret is often left, which affords a favorable ground for the growth bacteria other than the gonococcus.

As a result of uncleanliness and balanitis, the organisms enter urethra through the meatus; or in cases of obstinate constipat they make their way into the blood circulation from the rectum, discharged with the urine, and are deposited in the diseased sp in the urethra. Here they find a favorable culture medium in pus which is present, and can lead to the same complications prostatitis and epididymitis which occur in a true gonorrhea.

In general, however, the inflammatory process in a simple u thritis is less severe than in the gonorrheal form, and it is limited the mucous membrane, without involving the submucous tissues.

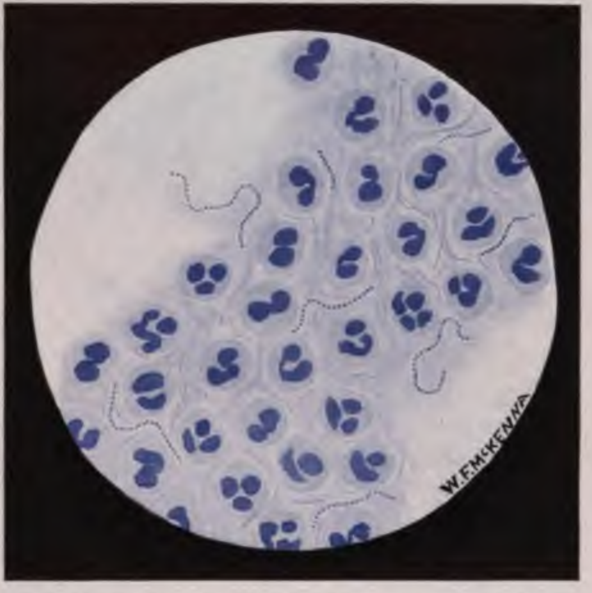

Fig. 1.—Bacterial urethritis. Streptococci in chains.

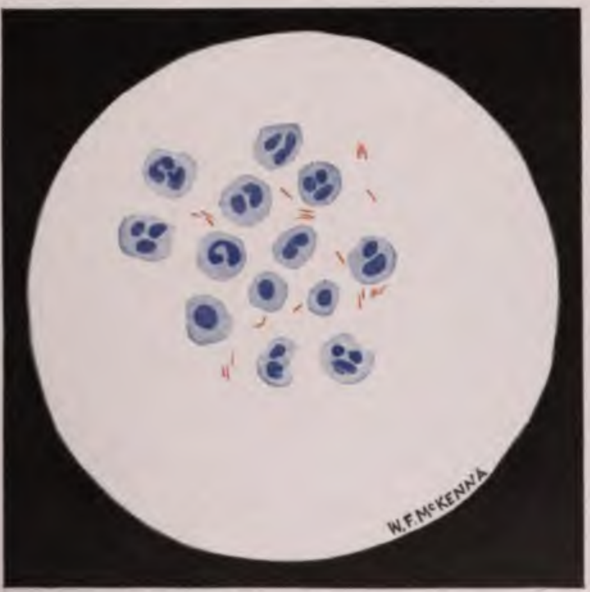

Fig. 2.—Tubercle bacilli. Ziehl-Neelsen stain.

PLATE XVIII.

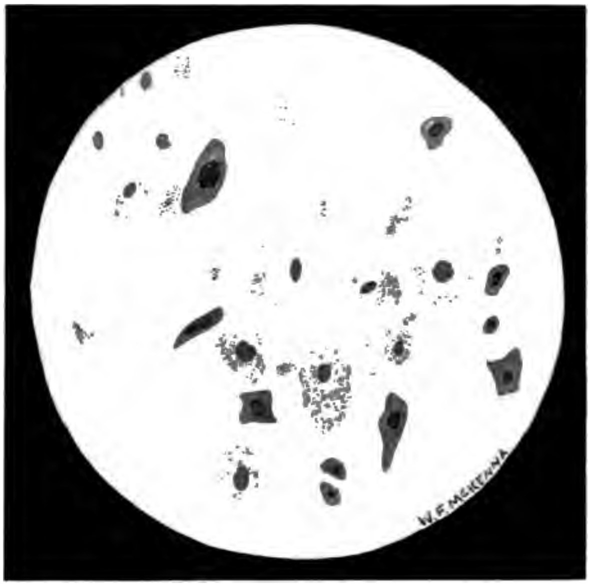

Fig. 63.—Catarrhal urethritis with epithelial desquamation and staphylococcic infection.

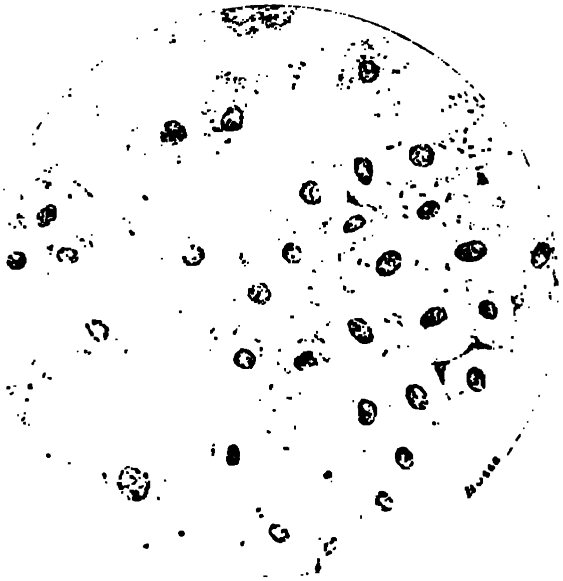

Fig. 64.—Simple or nongonococcic urethritis. Epithelial cells and diplococci. Original drawing from microscopic specimen.

## PRIMARY URETHRITIS OF BACTERIAL ORIGIN

Primary urethritis of bacterial origin is generally observed in men after coitus with women, suffering from free vaginal discharges, and who do not take the precaution of douching the vagina before coitus. On examining smears from the urethra, many different organisms may be found to be the cause of the inflammation, the most common being staphylococci, streptococci and colon; gonococci, of course, are not present in the discharge, but considerable care is sometimes necessary to differentiate some of the varieties of diplococci occasionally found from the gonococcus.

The inflammation caused by the introduction of these organisms into the urethra has often a longer incubation period, but runs a shorter and less severe course, than a true gonorrhea, and is not liable to have any complications.

While this statement is true of the vast majority of cases, Waelsch[1] and Galewsky[2] describe a urethritis characterized by a long incubation period, very slight subjective and objective symptoms, and an exceedingly chronic course, lasting in some cases four or five years.

In some of the reported cases, no organisms whatsoever were found; in others, streptococci, a milk-white diplococcus, and a slender bacillus were present, but the gonococcus was absent in every instance.

Another form of bacterial urethritis is occasionally met with in which the organism is a diplococcus closely resembling in form the gonococcus.

The inflammation caused by this organism begins insidiously after a longer period of incubation than true gonorrhea. There is but little discharge, slight tendency to involve the posterior urethra, and no sequelæ. A cardinal feature is the marked tendency to recurrence. The organism is probably identical with Heimann's pseudogonococcus and Pfeiffer's micrococcus catarrhalis. It occurs in pairs, of which the members are unequal in size. It is generally extracellular and decolorizes by Gram's method.

The resemblance to the true gonococcus makes the diagnosis difficult. The only way in which a positive diagnosis can be made is by growing the organism. It will grow on ordinary media, in the form of white opaque colonies, as well as on blood-serum agar. The fact that the true gonococcus refuses to grow on ordinary media serves to distinguish the two organisms.[3]

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[1] Prager med. Wchnschr., 1911, No. 43.

[2] Centralb. f. Harn. u. Sex. Org., 1903, No. 14.

[3] J. C. Johnston: Jour. Cutan. Genito-Urinary Dis., September, 1902.

In actual practice, a urethritis characterized by the presence of diplococci which decolorize by Gram's method is almost invariably due to infection with the true gonococcus of Neisser. Nevertheless, the possibility of the existence of the pseudogonococcus should be borne in mind, as otherwise the faith of a husband in the chastity of his wife or of a lover in the exclusiveness of his mistress may be unjustly destroyed.

## SECONDARY URETHRITIS OF BACTERIAL ORIGIN

In many cases of gonorrheal inflammation of the urethra a mixed infection with other organisms takes place which persists for a long time after the gonococci have disappeared.

After a gonorrheal inflammation the cylindrical cells of the mucous membrane become replaced by squamous epithelium which affords no protection against the growth of common bacteria.

In patients with a long foreskin and a chronic balanoposthitis, the organisms find their way into the damaged urethra and their growth continues until the focus is removed by circumcision.

Such a urethra changed by a long-continued gonorrheal inflammation is very vulnerable and liable to react sharply whenever common bacteria are introduced into it. In this way the cases of bacterial urethritis following coitus with women free from any marked leucorrhea may be explained.

### Treatment

The treatment of simple urethritis consists in hygienic measures, rendering the urine bland, and the use of a mild astringent injection which answers very well for the light cases. If irrigations are used, the nitrate of silver (1:4000) frequently causes a prompt subsidence of the discharge, because the microorganisms do not penetrate deeply into the tissues, but grow on the surface of the mucous membrane. Here the irrigation of nitrate of silver comes in direct contact with them and destroys them, and at the same time causes a desquamation of the superficial cells upon which the germs have proliferated. One or two irrigations may succeed in ridding the tissues of microorganisms and infiltrated epithelial cells.

This statement does not apply to the cases described by Waelsch, which are exceedingly obstinate and do not appear to respond to any form of local treatment. Galewsky believes that better results are obtained from the use of the balsams internally than from irrigations, used alone or combined with dilatations.

In the last few years the introduction of *oxycyanide of mercury* into urologic practice has given us an efficient antiseptic for irrigating the urethra.

It is regarded as the sovereign remedy for all septic conditions except those caused by the gonococcus, and destroys most organisms when used in the strength of 1:4000, which does not irritate the urethra or bladder.

By using it before passing a sound or catheter, it is possible to sterilize the urethra to a large extent, and in cases of simple urethritis its use is to be preferred to nitrate of silver on account of its unirritating qualities. Bichloride of mercury, 1:20,000, is also very useful in destroying the staphylococcus in the urethra.

After the urine has become clear systematic weekly dilatations of the urethra by sounds or the Kollman dilator should be used in addition to the irrigations.

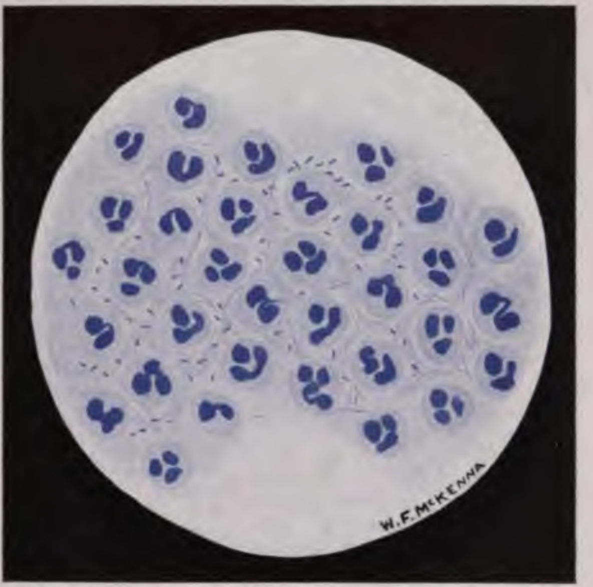

Fig. 1.—Bacterial urethritis. Colon bacilli.

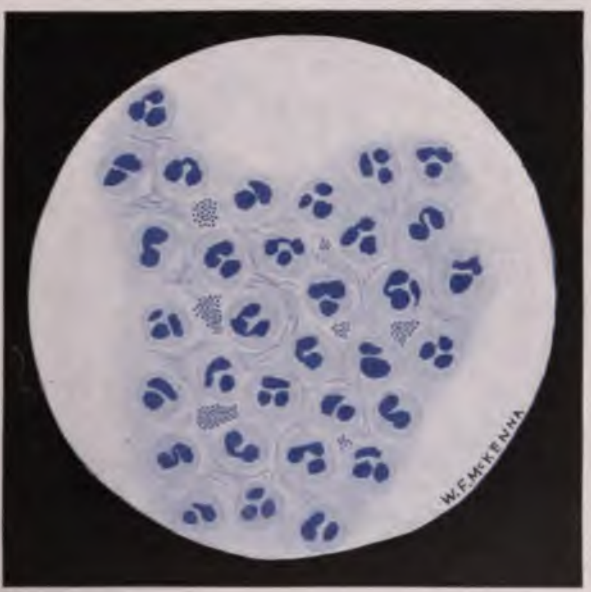

Fig. 2.—Bacterial urethritis. Staphylococci.

PLATE XIX.

# CHAPTER XII

## GONORRHEA

Gonorrheal inflammation of the urethra is caused by the **gonococcus of Neisser.** The period of incubation is usually from four to seven days, but in rare instances may extend to fourteen days.

### Pathology

The gonococci are introduced into the urethra, usually in utero-vaginal secretions or upon an infected instrument. They do not remain upon the free surface of the urethral mucous membrane, but rapidly penetrate between the epithelial cells, and are to be found in the submucous connective tissue itself. They increase and multiply in colonies, in the interepithelial spaces and upper layers of the submucous connective tissue, and the toxic substances which they produce cause reaction on the part of the tissues, which is characterized by dilatation of the blood vessels and discharge of serum and leucocytes. The cylindrical epithelium cells lining the urethra are loosened by the flow of secretion and are desquamated, forming **erosions** of the epithelial surface.

An active process of **phagocytosis** takes place, by which the gonococci are taken into the pus cells and thus removed from the tissues, and, in cases which run a normal course, the gonococci have almost entirely disappeared from the submucous connective tissue and deeper layers of the mucous membrane by the end of the second or third week.

When the *stage of decline* commences, the epithelial erosions begin to undergo repair, by being covered with squamous epithelium in many layers. The gonococci which have been removed from the deeper tissues now begin to grow luxuriantly on the free surface of the mucous membrane after the manner of a sod of grass, and a desquamation of the upper layer of the newly formed epithelial cells takes place, carrying with them their attached colonies of gonococci.

In normal and ordinary cases the process of getting rid of the gonococci is accomplished in the *ascending stage* by *phagocytosis,* and in the *stage of decline* through *desquamation* of the *epithelial* *cells;* so that in the fifth or sixth week, in favorable cases, the gonococci have disappeared entirely from the urethra, and the inflammation ceases.

**Morgagni's crypts and Littré's glands** are also affected by the inflammatory process, which occurs *within* their cavities as well as around them, and the duct walls become infiltrated and stiffened.

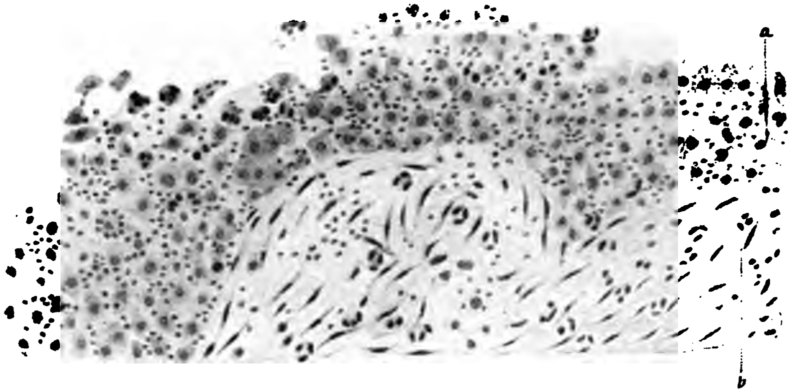

Fig. 65.—Acute gonorrhea. *a*, cylindrical epithelium, infiltrated with pus cells and gonococci; *b*, submucous connective tissue, with pus cells and gonococci. (From "Die Syphilis und die Venerischen Krankheiten," by Dr. Ernest Finger.)

The cavities of the glands act as foci of suppuration and incubating places for gonococci for months after the inflammation has ceased on the free surface of the mucous membrane.

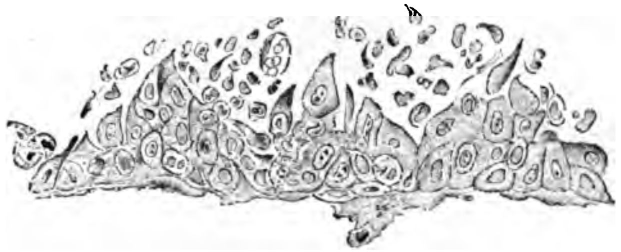

Fig. 66.—Gonorrheal conjunctivitis. Invasion of epithelial layer by gonococci, and desquamtion of the superficial layers of cells.

The final termination of this infection of the glands is by thei destruction through sclerosis, obliteration of their ducts or by the transformation into cysts. An **infiltration of small round cel** which are derived from a proliferation of the fixed connective-ti sue cells, and from leucocytes which have escaped from the capi laries, occurs as part of the process of inflammation, and may (*a*) **superficial,** or confined to the mucous membrane and its co nective-tissue layer immediately underneath, and dipping down and surrounding Morgagni's crypts and Littré's glands, or may be the (*b*) **deep form,** in which, in addition to affecting the mucous membrane and glands, the small round-celled infiltration involves the *deeper* submucous tissues, extending into the spongy tissue of the corpus spongiosum, in severe cases. The crypts and follicles are usually surrounded by and imbedded in the small round-celled infiltration.

**Healing of the lesions** is brought about by a removal from the tissues of the gonococci, through (*a*) phagocytosis and (*b*) desquamation of the epithelial cells, which have been invaded by the gonococci. When the gonococci have been entirely removed, suppuration ceases.

The *erosions* either (*a*) become covered with squamous epithelium in many layers, which offers a barrier to the renewed invasion of the tissues by gonococci, or (*b*) the erosions remain without being covered by squamous epithelium, but become the seat of *granulations,* and occasion a gleety discharge.

The *small round-celled infiltration* (*a*) disappears by absorption, especially when superficial and confined to the mucous membrane, and the urethra becomes healthy, soft, and flexible, or (*b*) the small round-celled infiltration is *not* absorbed, especially when deep-seated, *i. e.*, involving submucous tissue and cavernous tissue of the corpus spongiosum,—but becomes *transformed* into *true fibrous connective tissue,* called *stricture.*

**Relapses** are frequent, and are due to reinfection of the submucous tissues from a focus of suppuration located either in (*a*) Morgagni's crypts or Littré's glands, (*b*) the seminal vesicles, or (*c*) Cowper's glands or the (*d*) tubules of the prostate gland.

The manner in which a relapse takes place is as follows: If premature coitus or an excess of beer is indulged in, hyperemia of the mucous membrane, with increased secretion, follows and the protecting layer of squamous epithelium is torn asunder. The gonococci penetrate through these clefts into the deeper tissues and again cause their irritative symptoms.

If the gonococci remain in the urethra for a considerable length of time a state of tolerance of the tissues is established and with each successive relapse the inflammatory reaction becomes less and less until, with the third or fourth relapse the energy of reaction is not enough to bring the gonococci out of the submucous tissues. As a consequence, the gonococci remain and give rise to a permanent irritation of the submucous connective tissue, an infiltration of small round cells occurs, and the gonorrhea becomes *chronic*.

## Course

The inflammation begins at the meatus, and in *favorable* cases affects the *anterior* urethra only, stopping at the cut-off muscle.

**Stages.**—*Prodromal.*—The symptoms are a slight tickling at the meatus, and a light bluish, sticky discharge, with some slight stinging on urination. These last a couple of days, and then begins the *increasing stage:* The amount of pus increases. It is creamy yellow in color or greenish yellow from admixture with blood. Hemorrhages may occur. The pain on urination is intense, and is occasioned by the sudden distention of the infiltrated walls of the urethra by the outflow of urine. Neuralgic pains in the back, perineum, groin, and spermatic cord are present. Constitutional disturbance in the shape of fever and a feeling of prostration often occurs. The prepuce may become edematous and cause phimosis or paraphimosis.

**Chordee** is of frequent occurrence. It consists in an erection of the penis, with a painful incurvation downward. It is caused by an infiltration into the spongy tissue of the corpus spongiosum which surrounds the urethra and renders it rigid and inextensible. On account of the rigidity of the urethra the stream becomes small and twisted, and dribbling after urination occurs.

This condition continues without change for the better for about three weeks, and during this time it is known that the gonococci have been proliferating in the submucous tissues. At the moment when the gonococci have been removed from the deep tissues and begin to grow upon the free surface of the mucous membrane, the acute symptoms subside, and usually in the course of the third week the *stage of decline* begins. The pain on urination and the chordee lessen, the discharge becomes more watery and less in quantity, until it finally diminishes to a drop in the morning, which ultimately disappears.

**Endoscopic examination,** or the introduction of any instrument, should be strictly avoided in the acute stage. But if an endoscope were used, the appearance would be as follows:

The mucous membrane appears swollen, edematous, intensely red, and covered with pus. The glands and follicles are very markedly affected. The mucous membrane around their openings

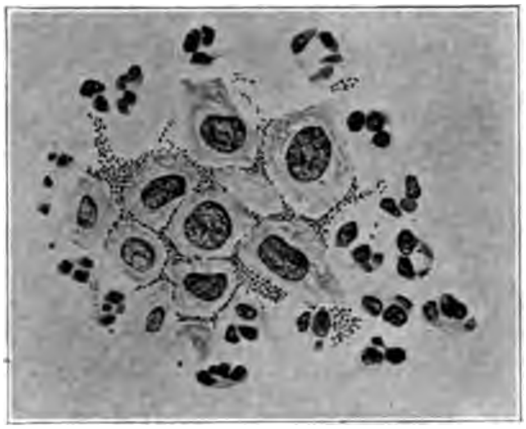

Fig. 67.—Acute gonorrhea. Prodromal stage. Clump of desquamated cylindrical epithelium, with colonies of gonococci growing between them. Original drawing from microscopic specimen.

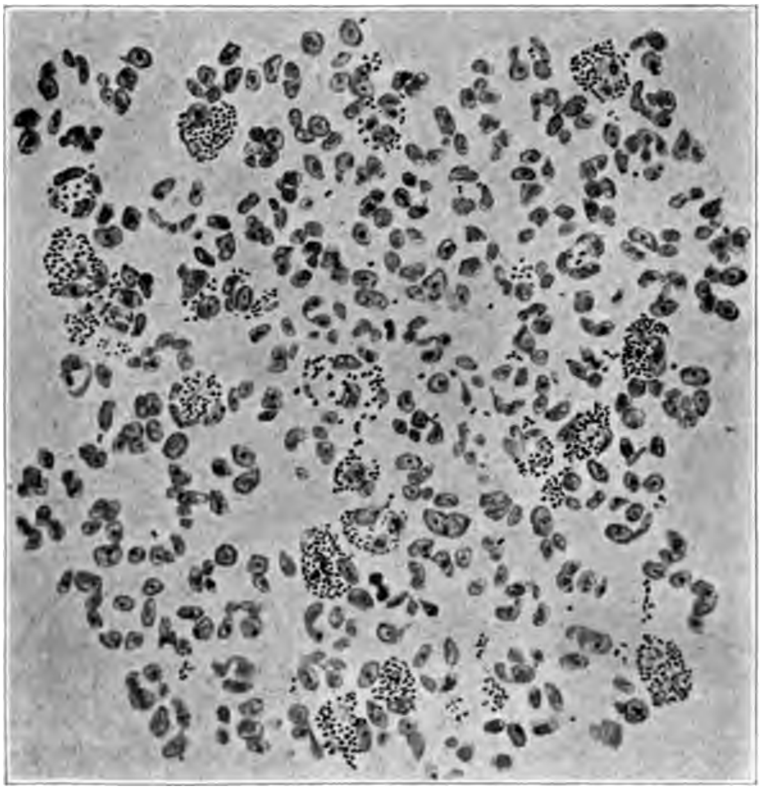

Fig. 68.—Acute gonorrhea. Ascending stage. Pus cells filled with gonococci. Original drawing from microscopic specimen.

is more swollen and the openings themselves gape. Erosions, from desquamation of the cylindrical epithelium, appear in the vicinity of the glands. Granulations may form upon the erosions, later in the course of the disease. The submucous tissue is infiltrated, rendering the canal swollen and rigid.

**Examination of Urine.**—The two-glass urine test should be made at each visit to determine:—

(*a*) If the *posterior* urethra has been affected.

(*b*) The amount of pus secreted.

The urine passed into a glass appears turbid from admixture with pus, and little clumps or masses of desquamated epithelium are present. After standing, the pus settles to the bottom of the glass, and a cloud of mucus appears floating above it. As the case goes on toward recovery the pus disappears, but the hypersecretion of mucus continues, and occasions a cloudy appearance in the urine, resembling mucilage added to it.

After the mucus disappears *clap-shreds* persist for months, showing that *isolated portions* of mucous membrane are *not covered* with *epithelium,* and are *still secreting pus.*

## Microscopic Examination of Pus

In the prodromal stage, when the discharge from the meatus is thin and scanty, microscopic examination of smears shows quantities of desquamated, cylindrical, epithelial cells and a moderate number of pus cells containing clumps of intracellular gonococci.

In the ascending stage large numbers of pus cells, many of them containing gonococci, and a number of free gonococci are to be seen, on account of the cells having ruptured, allowing them to escape.

The stage of decline is denoted by the appearance of squamous epithelial cells, showing that the erosions have begun to cicatrize and become covered with newly formed epithelium.

Clumps of gonococci are also present, adhering to the epithelium.

The pus cells have diminished in numbers and fewer of them contain gonococci. As the disease continues to improve, pus cells and gonococci disappear, and finally the discharge from the meatus is found to be composed only of squamous epithelium, mucus, an occasional pus cell, and no gonococci.

It is of the *utmost importance* to make sure of the entire disappearance of all gonococci before permitting coitus, on account of the danger of infection in case the gonococci are not removed.

If no purulent discharge is obtainable from the meatus it is proper to excite a simple urethritis, by injecting the urethra with nitrate-of-silver solution, gr. x to the ounce.

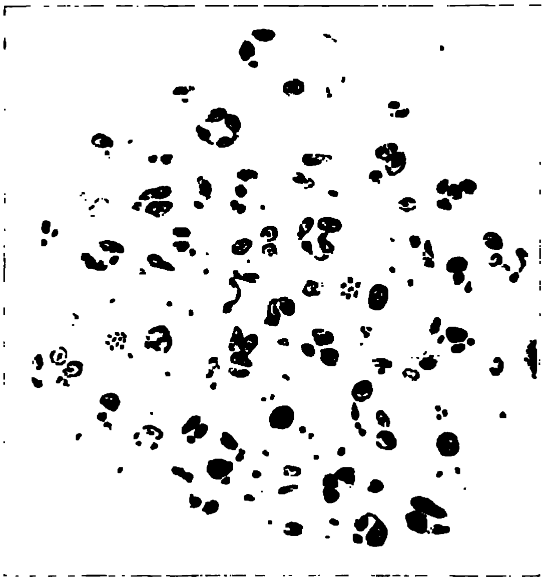

Fig. 69. Acute gonorrhea. Stage of decline. Desquamated squamous epithelium, with colonies of gonococci growing on them and pus cells. Original drawing from microscopic specimen.

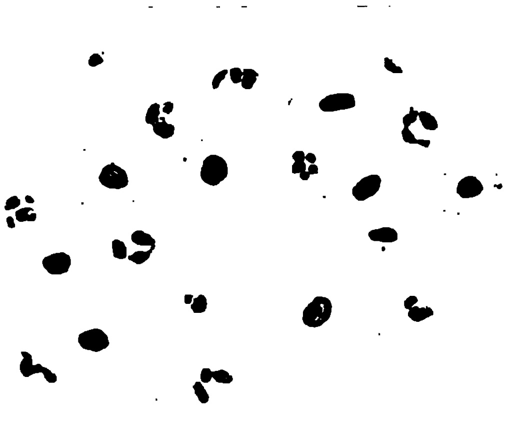

Fig. 70. Gonorrheal shred. Squamous epithelium and a few pus cells, held together [illegible]. Gonococci have disappeared. Original drawing from microscopic specimen.

If gonococci are lurking in the crypts or a granular patch, the suppuration caused by the injection will bring them to the face, and they can be found by microscopic examination of discharge.

The writer considers that the use of the microscope is indi sable in the management of cases of gonorrhea, not merely establishing the diagnosis, but also as a control for observing progress and stage of the disease, for selecting the appropr

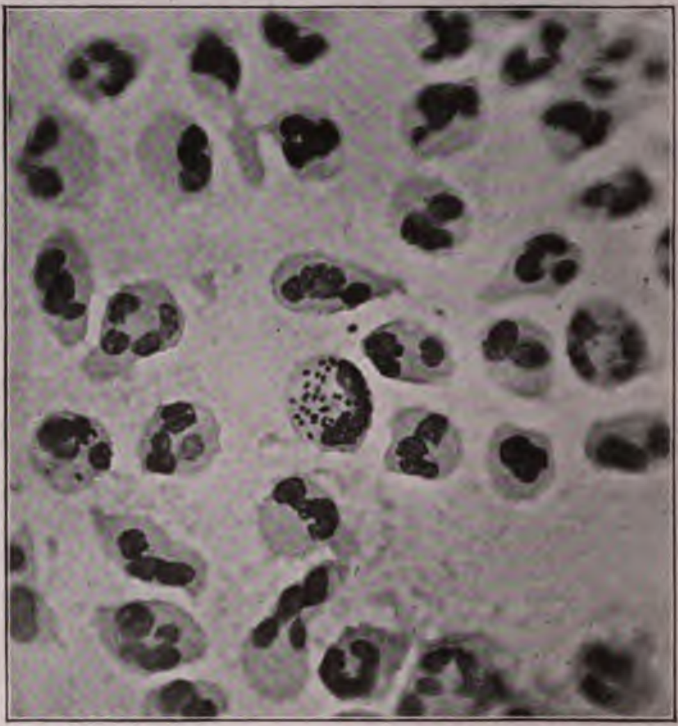

Fig. 71.—Pus cells containing group of gonococci. (Courtesy of Hoagland Laborato

treatment for the different periods, and finally to determine if gonococci have all been eliminated and the patient is cured.

## Morphology of the Gonococcus

The gonococcus resembles in appearance two coffee beans pl side to side, and, as it is removed by phagocytosis from the tiss will of necessity be found lying *within* the pus cells. A few g cocci may be found outside the pus cells, if these have been

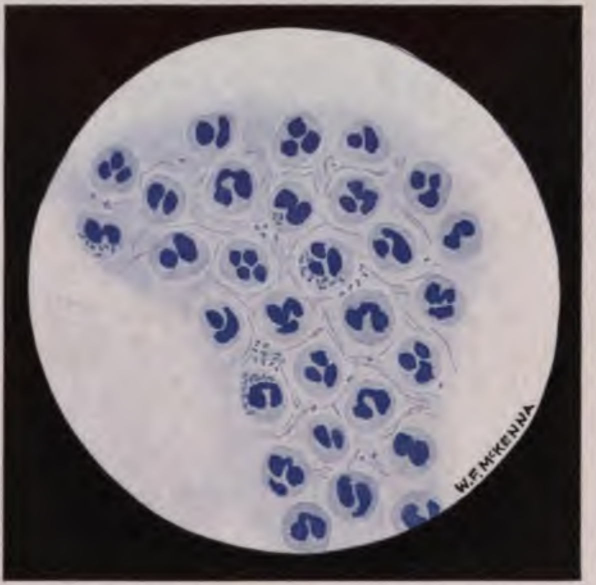

Fig. 1.—Gonococcic urethritis. Intracellular and extracellular gonococci stained with methyl blue.

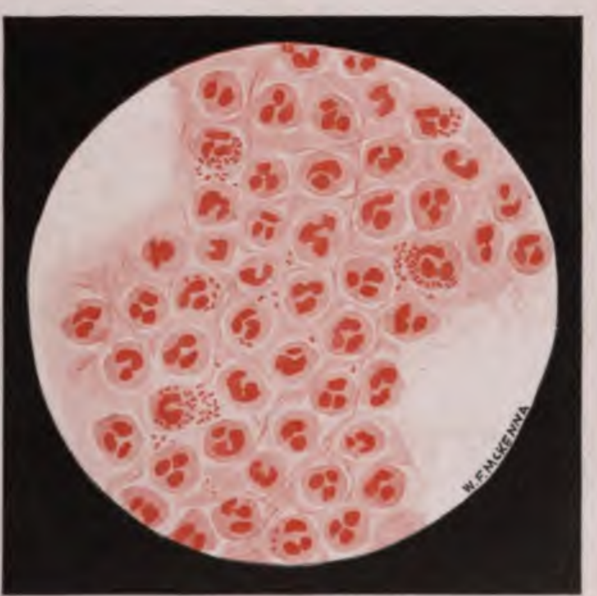

Fig. 2.—Gonococcic urethritis. Intracellular and extracellular gonococci stained with Gram stain.

PLATE XX.

tured. In the descending stage of gonorrhea the gonococci are found adherent to and growing upon the desquamated squamous epithelial cells.

Other microorganisms—for example, the pseudogonococcus—which are not pathogenic, resemble the gonococcus in shape, but it is believed today that the gonococci can, in the great majority of cases, be recognized by decolorizing them by Gram's solution.

The microscopic examination for the gonococcus is pursued as follows in the Hoagland Laboratory, after the method of A. Hymans Van den Bergh:

In the microscopic examination for the gonococcus it is well to have two smears of the pus on cover-glasses. One of these is stained with methylene blue, and if organisms are found which resemble the gonococcus the second smear is stained by Gram's method to confirm the diagnosis.

**Preliminary Staining.**—1. Make a thin smear on a cover-glass, of the pus supposed to contain the organisms.

2. Dry in the air and fix by passing three times through the flame, rapidly.

3. Stain for one minute in Löffler's solution of methylene blue (prepared by Eimer and Amend, or E. Leitz.)

4. Wash in water, dry, mount in balsam, and examine with a one-twelfth oil-immersion.

The gonococci are found on examination to be stained blue.

In order to differentiate the gonococci from other organisms present which may resemble them, the second smear is stained by Gram's method, as follows:

1. Stain in aniline-water gentian violet for five minutes.

2. Pour off excess of stain and cover with Gram's solution for one minute.

3. Decolorize with absolute alcohol until the smear is of a light grayish color.

4. As a contrast stain for those bacteria which are decolorized by Gram's method carbol fuchsin diluted with 10 volumes of water or a saturated watery solution of Bismarck brown may be used.

5. Wash in water, dry, and mount in balsam.

## Formulæ

*Nicolle's Modification of Gram's Method.*—Carbol-gentian violet is used in place of aniline-water gentian violet. Treatment with Gram's solution is carried out as above and decolorization is effected with a mixture of acetone (1 part) and alcohol (2 parts).

*Aniline-water Gentian Violet.*—To 10 c.c. of distilled water in a test tube add 1 c.c. of aniline oil. Shake thoroughly and filter through a wet filter until the filtrate is clear. To 9 parts of this aniline water add 1 part of a saturated alcoholic solution of gentian violet. This mixture will keep three to five days in a stoppered bottle.

*Carbol-gentian Violet.*—One part of a saturated alcoholic solution of gentian violet is mixed with 10 parts of a 5 per cent solution of carbolic acid.

*Gram's Solution.*—Iodine crystals, 1; potassium iodide, 2; water, 800.

Other microorganisms, the pseudogonococcus, for example, resemble the gonococcus of Neisser in form, and the differential diagnosis is made by using *Gram's method of staining.*

If the organism decolorized, it was formerly considered an absolute proof that it was the gonococcus of Neisser. If, however, it did not decolorize, it was thought that we had to deal with the pseudogonococcus.

The absolute reliability of the Gram test has been somewhat shaken by later observations, for it is now known that a few other organisms will also decolorize by Gram.

Steinschneider and Galewsky have found, however, that the Gram test can be depended upon in 95½ per cent of the cases.

It is believed today that the only way to determine the character of a suspected organism is to make a culture.

The growth of the organism on blood-serum agar or similar culture media, and its failure to grow on ordinary agar, glycerin agar, and gelatin, proves absolutely the organism is the true gonococcus of Neisser.

## Duration of an Attack of Gonorrhea

When the posterior urethra is not affected a favorable case of gonorrhea recovers in from five to six weeks. In very exceptional instances recovery may occur in three to four weeks, but in these cases there is always a doubt as to the correctness of the diagnosis of true specific gonorrhea, although under the modern treatment with silver albuminate salts the duration is materially shortened.

The first attack is the most severe, but most liable to recover without stricture. Later attacks are apt to follow the course of the first one, in having a repetition of the complications.

The virulence of the cultures of the gonococcus seems to differ materially.

It is often noted that when an individual has had chronic gonorrhea for months or years the gonococci when transplanted into the tissues of another person are not capable of producing such virulent inflammatory symptoms, as if taken from a fresh case.

This attenuated virulence would seem to explain the fact that in such cases the period of incubation is comparatively long, the purulent discharge is scanty, and the cases often become chronic, resulting in stricture and prostatitis. This course and termination are probably due to the fact that the irritation is too slight to cause enough phagocytosis to rid the tissues of the invading organisms.

Another condition which influences the prognosis in gonorrhea is the state of the patient's general health.

Gonorrhea acquired by an individual affected with phthisis or general debility is apt to run a subacute, but exceedingly protracted course.

**The causes which retard recovery** may be grouped as follows:

(*a*) Complications, posterior urethritis, prostatitis, etc.

(*b*) Reinfection from a urethral gland, seminal vesicle, prostate, etc.

(*c*) Lack of rest.

(*d*) Habits of drinking.

(*e*) Injections which are too strong or too frequently repeated.

(*f*) Constitutional causes: i. e., gout, tuberculosis, etc.

(*g*) Premature coitus.

## Prophylaxis

To avoid acquiring gonorrhea, coitus should not be too prolonged and should be limited to a single act, and the man should urinate immediately afterward to wash away any vaginal secretion which may have gained access to the urethra. This is by no means infallible, and in spite of such precautions infection very frequently occurs.

Finger advises the use of a condom, which is in no way injurious, and unless accidentally ruptured during coitus is a perfect safeguard against infection or impregnation.

Since the introduction of the albuminates of silver, a remedy has been placed in our hands which affords a reliable means of preventing gonorrheal infection.

Frank,[1] of Berlin, made experiments on six men into whose urethræ gonorrheal pus was artificially introduced.

Three of these received a prophylactic instillation of 3 to 5 drops of a 20 per cent solution of protargol dissolved in glycerin. The others were not so treated.

The three patients who did not receive the prophylactic instillation developed gonorrhea and the other three escaped. The experiment was repeated with the same result.

Kopp, Zeissel, and others have made similar experiments and confirm Frank's observations.

Since the introduction of Albargin, Frank uses a 5 per cent solution of this salt in glycerin, on account of its comparatively unirritating qualities, with the same results.

All the observers agree that the prophylactic instillation, if used immediately after coitus, will destroy any gonococci which may have entered the urethra, without causing any damage to the tissues.

Since the adoption of the prophylactic treatment in the U. S. Navy the reduction of the number of cases of venereal disease has been most striking. In a report published by Asst. Surg. W. S. Pugh, the method employed is as follows:

After his return from shore leave the sailor reports to the hospital steward, and after cleansing the genitals with soap and hot water, and urination, 1 c.c. of a 2 per cent solution of protargol with the addition of 15 per cent of glycerin are injected into the urethra and held five minutes.

Metchnikoff's calomel ointment is then applied to the penis and left on for two hours, to prevent syphilis. (See chapter on Syphilis.)

In the time covered by the report were 3,000 shore leaves, and 756 men who were exposed to venereal disease took prophylaxis and did not develop venereal diseases.

Compulsory prophylactic treatment has also been adopted in the United States army. Captain Chas. M. Williams of the Medical Reserve Corps, states that in one camp out of 1,934 men in whom venereal prophylaxis was given, we find none in whom gonorrhea developed, when the treatment was given in a reasonable time. Where gonorrhea occurred the interval between coitus and prophylaxis was seven hours or more.

The experience of Captain Ralph A. Warden of the Medical Reserve Corps, is similar, out of 56 men exposed who received prophylactic treatment only 2 developed gonorrhea and in these the treatment was employed 3½ and 10½ hours after exposure.

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[1] Allg. Med. Central. Zeitung, 1899, No. 5.

If the public in general were aware that reasonable efficient prophylactics existed which if used immediately after coitus would almost surely prevent gonorrhea and syphilis and the use of these remedies were to become common, one of the great questions of the day, viz., what can be done to prevent the spread of venereal disease, would be in large part answered.

## Treatment

Gonorrhea is a *self-limited disease,* and the suppuration may be looked upon as an effort on the part of the tissues to remove the invading microorganisms; so that when the last gonococcus is removed suppuration ceases, unless postgonorrheal lesions in the urethra and infection with other bacteria cause a catarrhal inflammation with secretion, and a discharge of pus continues.

**An expectant plan of treatment** can only be carried out exceptionally, as in military hospitals, for instance. Here it is found that if a patient with gonorrhea is put to bed and fed on a bland diet, consisting chiefly of milk, in forty-five days, on an average, the gonococci are eliminated from the tissues and the suppuration has ceased. Under the existing social and business conditions, however, such a plan of treatment is practically impossible, and we have to adopt the methodic treatment.

As the gonorrheal inflammation begins at the meatus and does not reach the posterior urethra until the third week, or in favorable cases not at all, we will first consider the treatment of inflammation which is limited to the anterior urethra, and take up posterior urethritis in a subsequent section.

From the earliest times many efforts have been made to abort the course of gonorrhea by using strong injections or pencilings of nitrate of silver and other caustics.

These attempts were all failures, and the increased irritation reacted most injuriously upon the course of the gonorrhea. Since the introduction of the albuminates of silver, **an abortive treatment** has been suggested which is sometimes successful. The favorable cases are those which present themselves for treatment a few hours after the discharge is first observed and in which the *microscope shows leucocytes, much epithelium, and gonococci which are extracellular.*

Such cases can often be cured in six or eight days if treatment is begun at once. (Wossidlo and Frank.)

If the gonococci are very abundant and the case is three or four days old, the attempt may be made, but the outlook is not very good.

*The method* of applying the abortive treatment consists in irrigating the anterior urethra once a day with a 1 to 1000 albargin solution, either with an irrigator with hydrostatic pressure (Janet method) or a large hand-syringe provided with a rubber tip.

The solution must be injected with the utmost gentleness and not forcibly, so as to avoid causing traumatism and prostatitis.

After the first injection the discharge is increased for a few hours, but in successful cases it becomes scant, slimy, and free from gonococci in from two to four days.

Gonosan is given internally, and the patient uses albargin as a hand injection once a day.

After five or six days, if the patient seems cured, a provocative injection with silver nitrate is made, to make sure that no gonococci are present.

Of 122 cases reported by Zenzes, 61 were cured within a few days.

If the pus continues, but the gonococci have disappeared, permanganate irrigations are useful in diminishing the discharge.

If after four or five days of this treatment, it is evident that the disease can not be cut short, it must be treated as an ordinary case of gonorrhea.

Another plan of abortive treatment is suggested by Ballinger and said to be frequently successful. It consists in injecting 25 minims of a 5 per cent solution of argyrol into the urethra and sealing the meatus with noncontractile collodion so that it is retained for six hours, when the collodion is washed off with acetone and the patient directed to drink half a gallon of lithia water to flush the canal. This application is repeated each day for a week and at the end of that time if there is no discharge or shreds in the urine the patient is directed to drink beer to prove the cure. Success in the treatment according to Ballinger depends upon the organisms being limited to the anterior urethra and retaining the argyrol for at least six hours daily. The argyrol solution should be freshly prepared each day as a stale solution is less potent and more irritating.

## ANTERIOR URETHRITIS

### Methodic Treatment

There are certain **hygienic** directions which the patient should observe: he should keep quiet and spend as much time lying on a sofa or bed as possible.

It is very unfortunate that the business and social requirements of a patient with acute gonorrhea do not permit him to go to bed in every case, for the first week at least. If this were done in each instance posterior urethritis, prostatitis, and other complications would rarely occur, and in the end many patients would actually save time, by sacrificing a few days at the beginning of the attack. Every gonorrhea is a severe acute inflammation and demands rest in bed as much as an inflamed joint, and if treated with equal consideration would respond by certain and prompt subsidence. He should be warned of the danger of gonorrheal ophthalmia, and directed to wash his hands after handling the penis or dressings, to avoid carrying any pus into the eyes. He should also be directed to avoid all sources of sexual or erotic excitement.

The **diet** should be nonstimulating, and the patient should avoid meat in excess, highly seasoned or salty foods, sauces, condiments, strong tea or coffee, pickles, tomatoes, asparagus and alcoholic drinks of all kinds, of which beer and champagne are especially detrimental.

**Dressings** for the purpose of catching the discharge and keeping it from the clothing are always necessary. The best form is made by cutting off the foot of a stocking and placing some absorbent cotton at the bottom; the penis is placed within it and the bag suspended from a waist-band, or the gonorrhea bag which is sold in the shops answers the same purpose.

*Constricting* the penis by wrappings should be carefully avoided, so as not to interfere with the return circulation. If the discharge is but trifling, a pledget of cotton may be placed under a long foreskin to absorb it; but the cotton is not to be recommended if the discharge is profuse, as it will prevent the pus from flowing out freely from the meatus, and cause it to dam back.

A *suspensory bandage* should be worn in every case to relieve the sensation of *dragging* on the spermatic cord and perhaps lessen the danger of epididymitis.

### Therapeutic Treatment

The *balsams* of copaiba, cubebs, and sandalwood oil have had for years a well-deserved reputation as antiblennorrhagics. They are eliminated by the kidneys, and affect the inflamed urethra as they pass over it, held in solution in the urine.

Sandalwood is best adapted to the increasing stage, but acts well throughout the whole course of the disease. It may be combined advantageously with fl. ext. of kava-kava in 5-minim doses in capsule. This combination is known as *gonosan.* The balsams of copaiba and cubebs have fallen largely into disuse, but are sometimes serviceable in the descending stage of gonorrhea.

The dose of sandalwood oil and the balsams is from 10 to 20 drops in capsules, three times a day.

Sandalwood oil sometimes causes an intense pain in the back, or disagrees with the digestion, and has to be abandoned on these accounts, while copaiba often causes an erythematous eruption resembling measles.

While sandalwood oil and the balsams are useful adjuvants in gonorrhea, it is necessary to have recourse to other measures to effect a cure.

## Treatment of the Increasing Stage

The bowels should be regulated by a saline cathartic given every second morning before breakfast, which depletes the pelvic blood vessels and lessens congestion, and prevents the migration of the colon bacillus from the rectum to the urethra.

*Alkalies or an alkaline mineral water* should not be prescribed as a routine measure, for an alkaline reaction of the patient's urine is always caused by his abstinence from meat and his free use of milk and the best prophylactic against the development of cystitis in gonorrhea is a strongly *acid reaction* of the urine, which inhibits the growth of any bacteria which may find their way into the bladder.

*Diluents.*—The patient should be directed to drink considerable quantities of pure distilled water—a glass every hour or two—with the object of *washing out* the urinary passages and keeping the urethra free from secretions which would otherwise form excellent culture media for gonococci.

Sandalwood oil is administered by the mouth, preferably in capsules. The well-known Lafayette mixture is commonly used in hospital and dispensary practice, but it has the disadvantages of containing an alkali and of having an abominable taste. Its formula is as follows:

| | | |
|---|---|---|
| ℞ | Extracti hyoscyami fluidi | fʒss |
| | Potassii citratis | ℥j |
| | Olei santali flavi | f℥ss |
| | Aquæ destillatæ | f℥ij |
| | Syrupi acaciæ | q. s. ad f℥vj |
| | Olei gaultheriæ | fʒss |

M. Sig.: Two teaspoonfuls at a dose.

The *burning* on *urination* is lessened in some degree by the sandalwood oil, but if very severe can be relieved by injecting ʒss of 4 per cent cocaine solution into the urethra.

The local treatment by means of *astringent injections* is *entirely contraindicated during the ascending stage,* for, as we have already noted in considering the pathology, the gonococci at this time are in the upper layers of the *submucous connective tissue* and the *deeper cells* of the mucous membrane, and they are being removed from the deeper tissues as rapidly as possible by the phagocytic action of the leucocytes. Under these conditions the action of an astringent is to hinder the elimination of the gonococci from the depths, and so retard the natural healing process.

A pure antiseptic, however—such as some of the new silver salts—is entirely in order, and is effectual in moderating the severity and shortening the duration of the disease.

The indications for the cure of gonorrhea as formulated by Neisser are as follows:

1. Destroy the gonococci in all foci within reach as early and completely as possible.
2. In doing so, avoid irritation of the mucous membrane, any exacerbation of the existing inflammation, and everything which has a caustic action on the tissues and all unnecessary pain.

The former plan of refraining from all local treatment in the ascending stage of a gonorrhea was only to be advised when no remedies existed which would destroy the gonococcus.

In the last few years, however, modern chemistry has provided us with a group of drugs which actually accomplish the conditions demanded by Neisser, and destroy the gonococci without injury to the mucous membrane.

They consist in a combination of silver with bodies from the albuminous group, are soluble in water, and not precipitated by contact with salt or albumin. They are accredited with the power of penetrating the deeper tissues and destroying the gonococci which lie underneath the mucous membrane.

The action of the silver salts is incomplete, and they do not destroy *all* the gonococci, particularly those in the mucous crypts and follicles; so that if their use is discontinued too soon, a relapse is liable to occur.

A great advantage of the treatment with silver salts, which may also be assisted by the internal use of sandalwood oil, is that the disinfection of the tissues advances rapidly and the spread of the inflammation is checked; so that, while under ordinary treatment posterior urethritis occurs in 80 per cent of the cases, in the patients treated with silver salts posterior urethritis is observed in from only 30 to 40 per cent of cases, and the disagreeable symptoms of excessive discharge, chordee, and burning on urination are very much lessened.

In point of time, while a very small percentage of cases are cured in from two to three weeks, under the treatemnt with silver salts, in the great majority of patients, in which complications do not occur, a continuous course of medication of five to six weeks is required, in order to effect a cure.

As the albuminates of silver all possess similar properties, albargin, protargol, and argyrol may be taken as types of the entire class.

These drugs may be regarded as pure antiseptics without astringent properties, and entirely unirritating to the tissues, so that they can be used in the ascending stage.

### Method of Using the Salts of Silver

It should be borne in mind that the local treatment of acute gonorrhea is only admissible when no complications, such as severe posterior urethritis, suppurative prostatitis, vesiculitis, etc., are present.

In an uncomplicated case the injections with the salts of silver may be begun at once, in the ascending stage.

The patient should be instructed that it is important to make the injections four or five times a day and from six to eight hours apart, and before using the injection he should urinate.

The solution of silver should be held in the urethra from five to ten minutes, in order to exert its destructive action upon the gonococci. A shorter time is insufficient and fails.

Protargol should be used in the strength of 2½ to 10 grains t the ounce; argyrol, 9 to 22 grains to the ounce, and albargin, whic is the most concentrated and is at present preferred in Germany, i the strength of 1 to 2 grains to the ounce, and 1:1000 in solution fo irrigations.

The weaker solutions are used at first, and the strength is i creased by degrees.

In using an injection the fluid must come in contact with th entire mucous membrane of the urethra and it must distend th bulb. The folds of the urethra must also be distended and t fluid should also press into the openings of Morgagni's crypts. T accomplish these objects the syringe must have a capacity of at least 4 drams, but Frank and Finger prefer to use an irrigator with a copious flow acting by hydrostatic pressure, as it is very difficult to distend the bulb sufficiently and force the fluid into Morgagni's crypts with a hand syringe. (See Janet Irrigation.)

Under the use of one of the silver salts as an injection, in the course of a few days the acute symptoms subside and the pain on urination and chordee disappear. It should be noted that, if treatment be discontinued at this point, even though the discharge has ceased and only a few shreds remain in the urine, a relapse is certain to occur in from two to three weeks, for a few gonococci have been left which were not destroyed, and reinfection occurs.

With the subsidence of the acute symptoms the strength of the solution should be increased, and it may be used four times a day, in order to destroy the gonococci more rapidly.

Another advantage possessed by protargol and albargin is that, in cases where the inflammation has passed beyond the cut-off muscle and attacked the posterior urethra, on holding a solution of either drug in the urethra for a short time the cut-off muscle relaxes, on account of the mild and unirritating character of the remedies, and allows the solution to flow back and come in contact with the posterior urethra and exercise its bactericidal power.

If a strong and irritating solution, like nitrate of silver, is injected into the anterior urethra, a reflex contraction of the cut-off muscle is always caused.

In a severe case of posterior urethritis any injection is inadmissible, but the very mild form without symptoms need not be regarded as a contraindication to local urethral medication.

Under the treatment with silver salts above described, in cases which run a favorable course, in about three weeks the discharge has become thin, watery, and scanty, and microscopic examination shows few or no gonococci, but many newly formed desquamated epithelial cells.

## Astringent Injections

Our task is now to cure the existing postgonorrheal lesions, which consist in a catarrhal inflammation of the mucous membrane, erosions, periglandular infiltration, and soft infiltration of the submucous tissues.

As the silver salts have only a destructive action on the gonococci, but no effect upon the inflammatory process, it is necessary at this time to treat the existing catarrh in the mucous membrane by some remedy with an astringent action, but, as there are usually a few gonococci still remaining, often hidden in Morgagni's crypts, it is necessary to continue the antibacterial silver salt in combination with an astringent.

The silver salt should be injected twice a day, and one of the following drugs used twice a day, at a different time, as an injection:

| | | |
|---|---|---|
| ℞ | Zinci sulphatis | gr. xij |
| | Resorcin | gr. xxiv |
| | Aquæ | ℥iv |

*Ultzmann's Injection:*

| | | |
|---|---|---|
| ℞ | Zinci sulphatis, | |
| | Pulv. aluminis āā | gr. iv to xij |
| | Acidi carbolici | gr. iv |
| | Aquæ | ℥iv |

| | | |
|---|---|---|
| ℞ | Zinci permanganatis | gr. j to ij |
| | Aquæ | ℥iv |

| | | |
|---|---|---|
| ℞ | Zinci sulphatis | gr. xv. |
| | Plumbi acetatis | gr. xxx |
| | Aquæ destillate q. s. ad | ℥vj |

Sig.: Insoluble. Hold in urethra, and let out drop by drop.

*Syringes* are of various shapes and made of soft rubber, hard rubber, and glass. An important point to observe is that the nozzle is not prolonged into a snout, which would irritate the mucous membrane of the fossa navicularis. In addition, it is essential that the syringe should hold from three to four drams of fluid, so that when the injection is given the folds of the urethra may be fully distended.

Technic of Injecting.—The patient urinates to cleanse the urethra, and then holding the penis in the left hand, draws it out while with the right hand the injection is slowly forced from the syringe into the urethra and held for two to five minutes. It is not necessary to make pressure on the perineum to keep the fluid from entering the bladder, as the fluid is kept from flowing backward by the tonic contraction of the cut-off muscle.

An astringent injection should never be used in the presence of posterior urethritis or in the *ascending stage* of a gonorrhea, for until the stage of decline sets in, the gonococci lie deep within the tissues and entirely out of reach of astringents applied to the surface of the mucous membrane. In addition to being of no value in destroying the gonococci, astringents are actually harmful from the irritation which their use entails.

In the *stage of decline,* however, when the burning on urination is decreased and the discharge has become thin and watery, the gonococci are growing upon the free surface of the mucous membrane and can be destroyed by the application of the various injections which combine an antiseptic and astringent. At the same time the dilated blood vessels are contracted by the astringent and the inflammation, through their agency, is lessened.

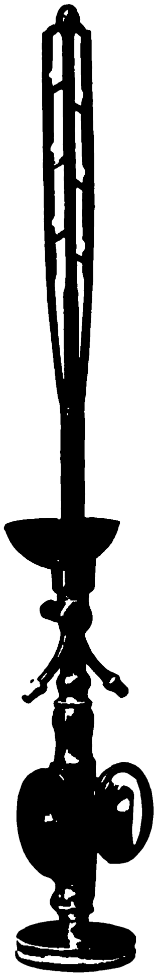

Fig. 72. Frank's irrigating dilator, for the anterior urethra.

An injection should never cause more than a slight burning. After a time the urethra becomes *tolerant* of *one* form of injection, and it is necessary to increase its strength or to change the formula.

After the gonococci have entirely disappeared from the discharge, the silver salt may be discontinued and the astringent injection used alone three or four times a day.

Under this treatment the discharge soon stops and the urine becomes clear and free from pus, but *shreds* are abundant.

When the shreds appear, the urethra should be irrigated with solution of silver nitrate in the strength of from 1:10,000 to 1:4000.

If a profuse discharge appears afterward, it indicates that there are still gonococci present in the tissues, and the treatment with the silver salt must be further continued.

When no relapse follows the nitrate of silver irrigation, and the urine is clear, but contains many shreds, **dilatation of the urethra** should be begun, either with a full-sized steel sound or preferably with Frank's anterior irrigating dilator.

The dilatations should be made once a week, possibly once in four or five days, beginning with 27, 28, or 30. The amount of reaction and secretion following is a guide to the frequency with which the dilatations may be used.

Each dilatation should be accompanied by an irrigation of nitrate of silver, 1:4000 to1:2000, or ichthargan, 1:4000; or if staphylococcus, streptococcus, or the colon bacillus is present, oxycyanide of mercury, 1:4000, should be used.

Albargin or protargol is not called for at this stage, as the gonococci are mostly removed from the tissues and an astringent is required.

The irrigating dilatations are continued until the shreds are gone and the patient uses a hand injection of one of the astringents three times a day, and a copious irrigation of the urethra should be made every second day with nitrate of silver.

Certain individuals do not respond well to this treatment, but improve rapidly under a daily irrigation of ichthargan or permanganate of potash. (Wossidlo.) Permanganate of potash is a mild antiseptic and astringent, and often acts very well in checking suppuration, although it has little or no action on the gonococci themselves.

An important question is, How long should the treatment of a gonorrhea be continued? It is not sufficient to stop medication when the discharge from the meatus ceases, for small quantities of secretion adhere closely to the walls of the mucous membrane, in thin layers, particularly in the bulb, and are only washed off by urination, appearing in the urine as shreds. The presence of shreds always shows that the inflammatory process is still active.

It is possible to treat a gonorrhea too long, for after the gonococci have disappeared an irritable hyperemic condition of the mucous membrane is left, which is characterized by the appearance of thin, transparent shreds. The secretion which appears at the meatus causes a slight sticking together of the lips in the morning, or, on squeezing, a small, transparent drop like glycerin appears.

If the use of strong injections is continued at this stage, the condition is made worse or the discharge increases and continues as long as the irritating injections are used.

It is always advisable to stop treatment for a time to allow the irritation to subside, and often the thin mucous discharge will spontaneously disappear.

But the question of how long to continue treatment and when to stop, can only be answered by the microscopic examination of the discharge. If gonococci are present, even though few in numbers, the antibacterial treatment must, of course, be continued, and if pus corpuscles are numerous, even though gonococci are not found, it is evident that a focus of suppuration is present somewhere, very often in one of Morgagni's crypts or one of the paraurethral glands, and a subsequent examination will probably reveal the presence of gonococci.

In such cases the antibacterial treatment should be continued, but when the microscope shows only a small quantity of pus and numerous epithelial cells treatment should be stopped, as the desquamation of epithelium is only harmfully increased by continuing. (Finger.)

After five or six weeks' treatment, if the discharge has stopped and the urine is free from filaments and the prostate and vesicles are not involved, treatment may be suspended, and if a week or ten days pass without symptoms the patient may be instructed to drink several glasses of beer.

If the beer does not cause a relapse, the patient remains for a fortnight under observation, and the urine is examined for shreds. An irrigation of the anterior urethra with nitrate of silver should be made twice, at different times, to cause an irritation, and the resulting discharge should be examined for gonococci.

If the chemical urethritis following the nitrate of silver ceases spontaneously in forty-eight hours and does not appear again, the microscope demonstrates the absence of gonococci in the and if the urine remains clear and free from shreds, the patient be discharged as cured.

Before giving him a clean bill of health, however, it is neces to examine the urethra with a bulb or urethroscope, and to in tigate the condition of the prostate and seminal vesicles, to make that these organs are free from disease.

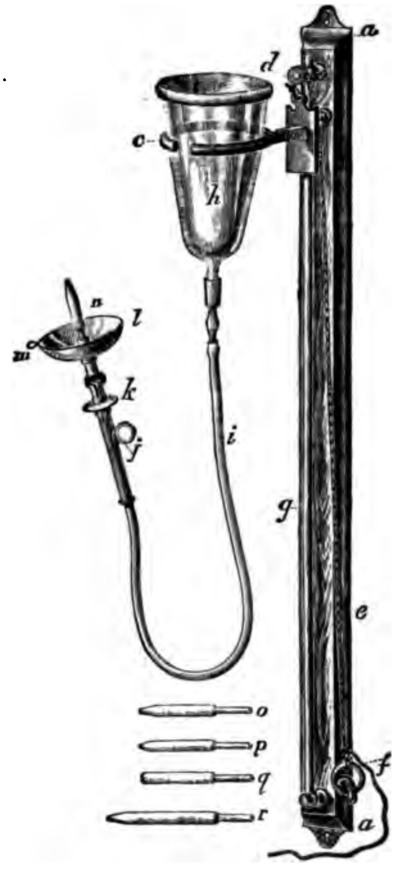

Fig. 73.—Valentine's irrigator.

### Irrigations with Permanganate of Potash: Janet's Method.

few years ago the treatment of gonorrhea, suggested by Janet Paris, by means of irrigations of permanganate-of-potash solu was extensively used. Its adherents were enthusiastic in prais its merits, Goldberg, of Cologne, citing statistics showing that 90 per cent of the cases of gonorrhea were cured in fourteen days by this means, but these claims as to its advantages would seem to be extravagant. According to the experience of other men who have used this form of treatment, it is impossible to attain any such results.

From the author's reading and experience with the Janet method, the following would seem to be a fair estimate of its value:

The profuse purulent discharge is checked, in most cases, in about eight days; but even under treatment *relapses,* accompanied by a free discharge of pus, occur in nearly every case, without apparent cause, and often several times. These relapses yield promptly to irrigations of permanganate, but the convalescence is retarded, and the irrigations have to be continued daily to hold the pus in check and to control the thin, serous discharge which lasts after suppuration ceases. The course of the case is in this way dragged out; so that at least one month, and very often two months or more, are required to effect a cure.

The *advantages* of the method are that posterior urethritis is of exceptional occurrence. The discharge from the meatus is so slight as not to cause any inconvenience, and there is no burning on urination and no chordee.

The *disadvantages* of the Janet method are the expense, trouble, and inconvenience entailed upon the patient by being obliged to report at his physician's office once or twice a day for treatment.

The objection which has been raised, that the frequent irrigation of the bladder or the relaxation of the cut-off muscle will in time do harm, is, I believe, entirely unfounded.

TECHNIC.—The patient sits easily, well forward on a chair, and rests his back against the back of the chair. The irrigator nozzle is inserted into the meatus and the anterior urethra washed out. If it is desired that the fluid should enter the bladder, the irrigator is elevated to the height of nine feet from the floor. The patient is instructed to take a long breath and attempt to urinate. As soon as the cut-off muscle is relaxed, the solution from the irrigator flows into the bladder, and when the bladder is filled the patient stands up and urinates, and the solution flows out through the urethra.

The urethra is irrigated twice a day for the first week, and then once a day till the patient is cured. The first irrigation is used of a strength of 1:1000 for its abortive effect, in the anterior urethra alone, and the second time of a strength of 1:6000. From this time on, the strength of the solution should be 1:3000.

As a rule, the first irrigation diminishes the secretion materially, and, when after a few days the secretion is scanty in amount and thin, the irrigation is allowed to flow through the posterior urethra into the bladder.

After the first week one irrigation a day is sufficient, and the strength may be increased to 1:1500, unless it causes tenesmus and bladder irritation.

The effect of permanganate irrigations is to cause energetic disinfection of the mucous membrane by removing and mechanically washing away accumulated secretions, as is the case with the irrigation of any suppurating wound cavity. The permanganate also causes an edematous swelling of the epithelial cells, which inhibits the growth of colonies of gonococci, but does not destroy them.

At the present time irrigations with permanganate of potash in the treatment of an acute gonorrhea are not used in this country as a routine measure, although in exceptional instances they are of benefit.

In France, however, the daily irrigations with permanganate of potash remain today the treatment of choice, while in Germany many genitourinary surgeons prefer the daily irrigations with albargin, 1:1000, or hegonon, 3 per cent, which is found to be less irritating, and, as Frank points out we are indebted to Janet for a method of bringing an antiseptic solution, such as one of the silver salts, in contact with all parts of the urethra, distending the folds and bulb, and very probably entering into Morgagni's crypts.

This method of irrigating the urethra, preferably with 1:1000 solution of albargin, is useful in the acute cases for its abortive effect, but it is especially called for in the treatment of chronic gonorrhea, after instrumentation of the urethra or massage of the prostate as long as gonococci are present.

After the gonococci have disappeared, but an infection with other organisms is present, the urethra should be irrigated with oxycyanide of mercury, 1:4000, or nitrate-of-silver solution, 1:4000.

## Treatment of Acute Gonorrhea Summarized

The treatment of each case of acute gonorrhea differs according to the severity and stage of the disease, and it is impossible to lay down a rule which will apply to every patient.

A general outline of the treatment, however, may be summarized as follows:

In each instance a microscopic examination of the secretion for gonococci must be made. No local treatment of the urethra by injection or irrigations is permissible when acute posturethritis, prostatitis, or vesiculitis is present until the complication has become chronic.

If a patient applies for treatment shortly after a suspicious coitus and if the discharge from the meatus is scanty, containing much mucus and epithelium, and only a few pus cells, and but few gonococci, many of which are intracellular, the *abortive treatment* may be attempted.

In the beginning of the ascending stage with slight subjective symptoms, discharge purulent and scanty, and gonococci not very numerous, daily anterior irrigations with albargin, 1:1000; permanganate of potash, 1:3000, or hand injections of a silver salt, 4 to 6 times a day, will in a few days lessen the quantity of the discharge and diminish the number of the gonococci.

If the ascending stage is fully developed when the patient presents himself for treatment and the discharge is free, purulent, and contains numerous gonococci, but if the inflammatory reaction is not marked, the local treatment with silver salts is strongly called for.

As the urethritis improves under the silver salts, the secretion becomes watery, and the gonococci are fewer in number, an *astringent injection* should be used, alternating with the injection of the silver salt, using each one twice a day at different hours.

Finally, after the microscope shows disappearance of the gonococci the silver salt is discontinued and the astringent used alone.

If after using the silver salt for a week no improvement occurs, it is better to change the injection and use another preparation.

The same holds good of the astringent injections, and their concentration must be gradually increased as the stage of decline progresses.

As soon as the discharge has become scanty and the microscope shows numerous squamous epithelial cells, irrigations of the urethra with nitrate of silver solution, 1:400, may be commenced, not so much with the object of making motile the gonococci in the deep tissues as for their antiseptic and astringent effect.

To avoid too much irritation they can only be used every second day, and in the intervals hand injections of an astringent must be continued by the patient.

If the nitrate of silver causes a relapse with free purulent discharge containing numerous gonococci, recourse must be again had to the silver salts.

Such relapses always denote a protracted course of the disease and call for a guarded prognosis as to time.

Under this treatment in an ordinary case of acute gonorrhea, at the end of the fifth or beginning of the sixth week the discharge has entirely ceased, the urine is free from filaments, and the treatment may be stopped.

The patient is advised to drink several glasses of beer. If no relapse follows he is kept under observation for at least two weeks. During this time his urine is examined for shreds, and a provocative irrigation of the urethra with silver nitrate, 1:1000, is made twice, purely for diagnostic purposes and with no therapeutic object.

If no gonococci are found in the resulting secretion, which ceases spontaneously in forty-eight hours, and if the urine remains clear and free from shreds, an examination of the prostate and seminal vesicles is made and the urethra explored with the urethroscope or a bulbous bougie, and if no lesions are discovered the patient may be discharged as cured.

If in the sixth week the discharge has not entirely ceased or the condition is made worse by the beer and provocative nitrate of silver irrigation tests, the case must be treated as described in the chapter on Chronic Gonorrhea.

In the fifth week dilatations of the anterior urethra with a large-sized sound or irrigating anterior dilator of Kollmann have a very favorable action, provided that the clinical picture is that of a subacute chronic urethritis.

The presence of a small number of gonococci in the secretion is not a contraindication to dilatation.

## BACTERIOLOGY OF THE GONOCOCCUS

By John H. Burke, M.D., M.R.C.

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The gonococcus, discovered by Neisser in 1879, is the specific organism of gonorrhea. It has been conclusively proved that wherever this micrococcus is found, a positive diagnosis is warranted. It is often difficult to demonstrate the specific organism in the subsiding and chronic cases, and for this reason a negative finding, unless frequently repeated with the same result, is not sufficient evidence upon which to positively exclude the nature of the disease.

## Morphology

The gonococcus is a biscuit- or coffee-bean-shaped organism, occurring most frequently in pairs, occasionally in tetrads, the flat or slightly concaved sides of the organism being approximated and a narrow space being visible between the halves of the coccus. It has been shown that several strains of the organism occur, and their size varies from 0.6 to 0.8 in the short diameter to 0.8 to 1.6 in their long diameter, the average being about 1.20 in the long diameter by 0.7 in the short. In smears made from the discharges of gonorrhea, the cocci appear to be intracellular and extracellular, the intracellular location being the more characteristic.

## Cultural Characteristics

When cultured on artificial media the gonococcus grows best at body temperature, or 37° C., although some growth may be obtained in temperatures as low as 25° C. Its resistance to heat is very limited, the maximum temperature for growth being 40° C., while 60° C. for 30 minutes or 45° C. for 5 hours will kill most strains of the cocci.

Because of its parasitic qualities, the gonococcus grows sparingly on the artificial media and only on those to which has been added serum albumin. The lack of an ideal medium is made manifest by the great number of culture media which one finds recommended by the various authorities. Serum agar, blood agar, sterile hydrocele fluid are the most common ones employed for primary cultures, while subcultures may be made on glycerin agar or nutrient agar. For the methods of preparation and formulæ of the above-mentioned media, the reader is referred to textbooks on bacteriology.

When cultures of the gonococcus are to be made, the material should be smeared over the surface of the slanted media, as it has been found that the organism grows best in the presence of oxygen and moisture. The tubes are then placed in the thermostat at a temperature of 37° C. and incubated. At the end of twenty-four hours colonies of gonococci can generally be seen macroscopically, although the different strains vary in the rapidity of their development, some requiring as long as seventy-two hours of incubation.

The growth obtained is delicate, the colonies small, and there is usually a contaminating growth of staphylococci or colon. The typical colony is discrete—grayish white or pearly gray in color; having a somewhat granular appearance with edges which may be serrated or wrinkled. Their appearance may be somewhat altered on the different media. Unless frequent transplantation is practiced, the organism dies out in a few days or is overgrown by the contaminating bacteria which are practically always present.

## Staining Reaction

The gonococcus stains readily with most of the anilin dyes, the important point being not to overstain the organism. For ordinary routine examination Löffler's methylene blue stain will satisfactorily demonstrate the organism. Film preparations of pus stained by this method will show the gonococci both outside and within, the leucocytes taking the stain deeply while the cytoplasm of the pus cell is but slightly colored. Dilute fuchsin, methyl-green-pyronin and gentian violet may also be employed.

The disadvantage of the above-mentioned stains lies in the fact that they stain other organisms as readily as the gonococcus.

The organism, in addition to its other peculiar characteristics, is Gram negative in its reaction to Gram's stain. This peculiarity affords a method of differentiation which excludes all but a few un commonly found cocci and should be employed wherever there i any doubt as to the identity of the existing organism.

Stained by this method, which is described fully in the appendi the gonococci are found to have been decolorized by the alcohol an have taken the counterstain. If fuchsin is used as a counterstai the organisms are observed to be red in color, as are also the le cocytes, while the Gram-positive cocci, especially the staphylococ have not been affected by the decolorizing agent, and have reserv the violet color imparted to them by the gentian violet.

The two organisms most commonly mentioned which may be m taken for the gonococcus on smear are the micrococcus catarrha and the diplococcus intracellularis meningitidis. Both are Gr negative and both are found within polymorphonuclear leucocyt While it is impossible to differentiate these from the gonococcus staining reaction, it is well to remember that neither of these org isms is often found in the genital tract and this is especially t in the male. However, if a positive identification of the existing ganism is absolutely necessary for medico-legal or other reasons, other methods than staining will have to be resorted to. For these cases cultures offer a more accurate diagnosis, but even this method is without value unless performed by one with special training in bacteriology.

Schaeffer and Steinschneider found a Gram-negative diplococcus other than the gonococcus in only 4.6 per cent of cases in a large series. This work seems to demonstrate that over 95 per cent of cases can be correctly diagnosed by Gram's method of staining.

## CHAPTER XIII

## POSTERIOR URETHRITIS

Posterior urethritis consists in an inflammation of the mucous membrane of the posterior urethra, which lies behind the cut-off muscle. In severe cases the inflammation may extend up out of the urethra and involve the base of the bladder.

*Acute* posterior urethritis is almost always caused by the extension of a gonorrheal or bacterial urethritis from the anterior part of the canal but the *subacute and chronic forms* may be the result of prolonged congestion from sexual abuses, complicated by germ infection from the rectum or from without.

Posterior urethritis is a serious complication of gonorrhea, because:

I. It increases the extent of the inflamed surface and renders recovery more remote.

II. On account of *complications,* which are almost sure to follow, if the pus is conveyed through the various ducts opening into the posterior urethra, to the prostate, seminal vesicles, testicles, and bladder.

Posterior urethritis occurs in 40 to 80 per cent of cases of gonorrhea, but is often so mild as to be overlooked. It usually develop from the second to the fourth week, or when the gonorrheal inflammation has extended to the bulb. It may be excited by the use of sound or catheter in an acutely inflamed urethra, which pushes the pu along in front of the instrument or causes traumatism, or it ma develop spontaneously.

The membranous urethra, in certain cases, acts as a barrier to t spread of an inflammation from the anterior urethra backwa toward the bladder. The cut-off muscle, which surrounds the me branous urethra, is in a state of tonic contraction, and acts like valve, and the mucous membrane lining the membranous urethra less vascular and provided with fewer crypts and follicles th either the anterior or posterior urethra, and also serves to check t extension of the gonorrhea.

Clinically two forms of posterior urethritis are met with: ( **mild or subacute form; (*b*) severe form.**

## Symptoms

The symptoms of the **mild form** may be so slight as not to attract attention. There is an ill-defined sense of weight over the pubes and a feeling of pressure in the perineum, together with slightly increased frequency of urination.

The symptom of increased frequency of urination depends upon the fact that, in a condition of health, the posterior urethra is the most sensitive part of the canal, and, when the bladder becomes filled and a few drops of urine trickle into the posterior urethra, their presence sets up a certain physiologic irritation, which is transmitted to the bladder, and produces a contraction of its muscular walls, which empties the bladder of its contained urine.

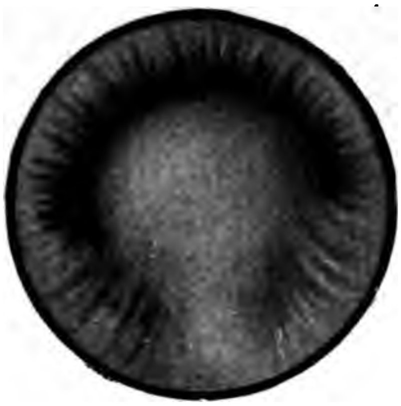


Fig. 74.—Normal verumontanum, the orifice of the prostatic utricle not visible. (From Luys-Wolbarst—*Cystoscopy and Urethroscopy*.)

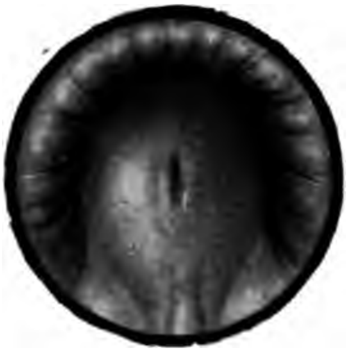


Fig. 75. Normal verumontanum, the orifice of the prostatic utricle visible. (From Luys-Wolbarst.—*Cystoscopy and Urethroscopy*.)

In posterior urethritis there is a congested state of the prostatic urethra and an abnormally acute sensitiveness; so that the stimulus to urinate is greatly increased.

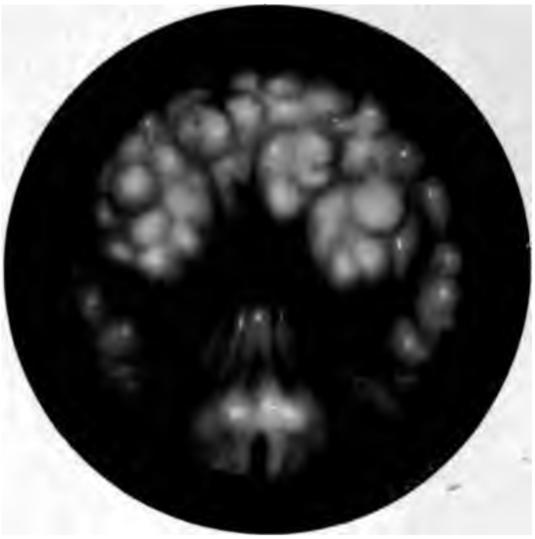


Fig. 76.—Glandular lesions of the anterior surface of the prostate seen with the urethroscope (From Luys-Wolbarst.—*Cystoscopy and Urethroscopy.*)

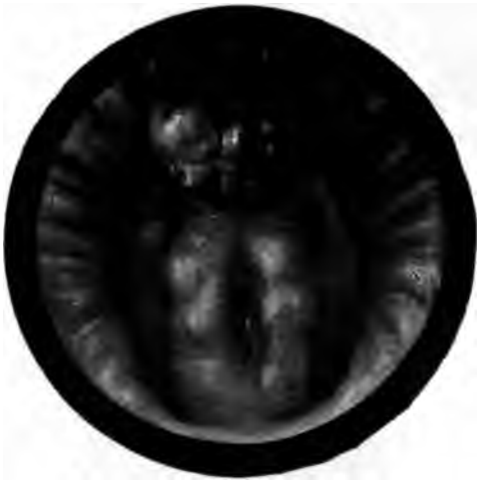


Fig. 77.—Polypus on the summit of the verumontanum. (From Luys-Wolbarst.—*Cystoscopy and Urethroscopy.*)

In the **severe form** of posterior urethritis the symptom of fr
quent and painful urination is very much aggravated. If the i

flammation is very acute and particularly if it has extended to the base of the bladder, violent vesical tenesmus sets in, which the patient can not restrain.

The squeezing together of the inflamed surfaces, by the muscular contractions of the bladder, not only causes intense pain, but also often ruptures some of the capillaries in the mucous membrane; so that a few drops of blood generally follow the act of urination.

No sooner has one spasmodic contraction of the bladder subsided than another one sets in, and these continue to recur every few minutes until the suffering becomes almost unbearable.

### Diagnosis

The diagnosis of the **severe** form of posterior urethritis can usually be made from the symptoms alone, but the **mild** form is apt to be overlooked, unless we direct our patient with gonorrhea to urinate in two glasses, each day we see him, and in this way we can detect inflammation of the posterior urethra in its incipiency.

The **two-glass urine test**, as devised by Sir Henry Thompson, is based upon the physiologic action of the cut-off muscle, which, by its tonic contraction, forms a barrier between the anterior and posterior urethra. Fluids injected into the anterior urethra can not flow back into the bladder, and pus lying in the posterior urethra is prevented from flowing out through the anterior urethra, but escapes backward into the bladder, and renders the urine which had accumulated in the bladder turbid and cloudy.

If suppuration is going on in the anterior urethra (the posterior urethra being healthy), and the patient is directed to urinate, the first gush of urine washes out the pus, and the urine, if caught in a glass, appears turbid. If the remainder of the urine, which had collected in the bladder and is uncontaminated, is passed into another glass, the urine in the *second* glass is clear.

If suppuration is present in *both* anterior and posterior regions of the urethra, the *first* glass of urine passed is, of course, turbid, from the pus washed out of the urethra, and the *second* glass will be *turbid also*, because the pus formed in the posterior urethra flowed back and stained the urine which was contained in the bladder.

Turbidity of the urine is sometimes caused by urates or phosphates. If uratic in origin, the cloudiness clears up on boiling, and, if phosphatic in character, a few drops of nitric or acetic acid will render it clear. The presence of pus can be determined by microscopic examination or by adding a few drops of liquor potassæ to the suspected urine, in a test tube, and twirling it rapidly. If pu is present it will be coagulated and float in long, ropy string through the urine.

Chemical examination shows more albumin than can be accounte for by the pus. This superabundance of albumin is not occasione by structural changes in the kidney, but by increased intrapelvi pressure, caused by the frequent and severe muscular spasms o the bladder.

In nearly every case of posturethritis developing in the cours of a gonorrhea, rectal examination will show that the prostate i more or less affected; and after the inflammation has disappeare from the posterior urethra, foci of disease remain in the prostate causing exacerbations of the gonorrhea and sexual neurasthenia.

In every case of gonorrhea which lasts an unusually long tim and when the second glass of urine is constantly or intermittentl turbid, and the pus contains gonococci, the prostate will almos invariably be found to be affected.

By rectal palpation, it will be noted that the prostate is swollen doughy in consistence, and with scattered spots of softening. On expressing the contents with the finger, a quantity of pus, frequentl containing gonococci, is forced out.

This examination is important and should never be omitted, as large number of cases of latent and chronic gonorrhea, which afte slight excesses show exacerbations, with pus and gonocococci in th secretions, are dependent upon chronic prostatitis. (Frank.)

### Treatment of the Mild Form of Posterior Urethritis

The irrigation of the urethra and the bladder by means of a irrigator, after Janet's method, is particularly adapted to cases o inflammation of the posterior urethra developing in the course of gonorrhea. There are three methods by which the posterior urethr and bladder may be irrigated:

*A*. By the Janet method, with an irrigator and hydrostati pressure.

*B*. By means of a large syringe with a removable soft-rubb tip.

*C*. By introducing a soft-rubber catheter beyond the cut-o muscle, so that its eye lies in the posterior urethra, and injecti solutions through it.

Methods *A* and *B* are to be preferred and are in most general u as the resistance of the cut-off muscle is easily overcome and t anterior and posterior urethra are irrigated thoroughly and the bladder filled.

The solutions to be used are albargin or protargol for the first few days, and as much longer as the process is acute or gonococci are present, and later on, after the process becomes subacute, nitrate-of-silver solution, from 1:10,000 to 1:4000, should be employed.

If the prostate is found to be diseased at the same time that posterior urethritis develops, its progress should be closely watched, and as soon as the acute condition has subsided, massage should be begun and continued until such time when no more pus can be expressed, but only a small quantity of secretion of an epithelial character.

Instead of using copious flushings of the urethra, with a considerable quantity of fluid, we can deposit a few drops of a concentrated solution of nitrate of silver directly upon the surface of the mucous membrane by means of Ultzmann's syringe. This syringe is introduced past the cut-off muscle, so that the end lies in the posterior urethra, and 15 or 20 drops of the solution are injected. Nitrate of silver, in strength ranging from 1 to 5 grains to the ounce, is the best application for the purpose.

If we desire to medicate the posterior urethra alone, the patient should retain some urine in the bladder. The urine will neutralize the solution as it flows into the bladder. If a urethrocystitis be present, the patient should *empty* his bladder first, and the injected fluid will then medicate the posterior urethra and flow back and affect the base of the bladder as well.

As to a selection between the methods of irrigation and instillation, as a general rule, it is found that recent cases with an abundant purulent secretion and which are free from pain or other acute symptoms are most benefited by copious irrigations, and that after the discharge has diminished, so that the urine is clear and only shreds are present, instillations are more serviceable.

**Diuretics**—such as triticum repens, uva ursi, buchu, etc.—are not indicated in posterior urethritis, since, although they render the urine bland and unirritating, they increase the quantity secreted, and occasion more frequent calls on the bladder to empty itself.

## Treatment of the Severe Form of Posterior Urethritis

In this form any kind of mechanical interference with the urethra—such as injections, irrigations, or the introduction of any instrument—should be *rigidly avoided*. The patient should go to bed in order to secure rest for the inflamed posterior urethra, lessen its congested condition, and so diminish the vesical tenesmus.

A mild saline cathartic is useful by reducing the congestion of the pelvic organs. Milk should be the staple article of diet, to render the urine bland and unirritating. *Sandalwood oil* acts almost like a specific in some cases. After a few doses the tenesmus lessens and the escape of blood after urination ceases.

*Alkalies* or *alkaline mineral* waters are contraindicated, for the reason that the urine in the bladder is necessarily neutral or alkaline in reaction, on account of the abstinence from meat and the milk diet ordered. If the urine becomes alkaline and pyogenic microorganisms make their way into the bladder from without, a suppurative cystitis is almost sure to occur; so that a moderate degree of acidity of the urine is regarded as the best prophylactic against cystitis.

In order to maintain this condition of acid urine, it has been advised of late to administer *salicylate of soda*, gr. xx three times a day, as this drug has the property of causing a strong acid reaction in the urine.

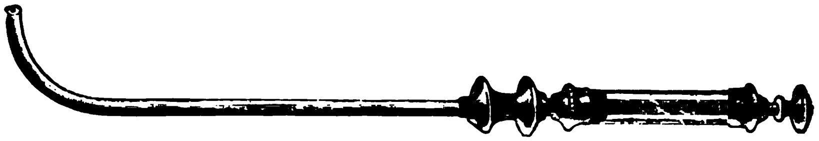


Fig. 78.—Ultzmann's syringe.

*Morphine* is generally required to relieve the excessive tenesmus and allay the frequent desire to urinate. The frequent desire fo urination has a bad effect upon the inflammation, since the contrac tions of the bladder cause an increase in the hyperemia at its base Morphine may be given by the mouth, but preferably in suppository

*Hot sitz-baths* prolonged for half an hour and used several time a day sometimes lessen the tenesmus and desire to urinate; bu while useful as an adjuvant, they will hardly take the place o opium.

When these methods fail to relieve the tenesmus and pai which may be intense, the **instillation** of 10 drops of nitrate silver with an Ultzmann syringe into the posterior urethra ofte succeeds in calming the disturbance in a few hours. It is desirab to begin with gr. j to the ounce and increase up to gr. v to the ounc using it every second or third day.

It is always better to use the instillation as a last resort, sin we can lay it down as a rule from which there are few departur

"Never to introduce an instrument into a urethra affected with *acute* inflammation."

After acute symptoms have passed off, the case assumes the characteristics of the *mild* form of posterior urethritis, and can be treated as such.

### Résumé of the Treatment of Acute Gonorrhea

**Abortive Treatment.**—*Favorable Cases.*—In commencement, gonococci scanty and extracellular; much epithelium; few leucocytes. Daily irrigations, albargin 1:1000.

**Methodic Treatment of Ascending Stage.**—*Examination.*—Microscopic: Pus abundant; gonococci intracellular. Urine, glass 1 turbid, glass 2 clear.

*Treatment.*—Sandal oil internally. Injection of silver salt three times a day, albargin, protargol or argyrol.

**Stage of Decline** (third week).—*Examination of Early Period.* Microscopic: A few pus cells, few gonococci; many squamous epithelial cells. Urine, glass 1 turbid, glass 2 clear.

*Treatment.*—Injection of silver salt continued, also begin astringent injection.

**Later Period.**—*Examination.*—Microscopic: Few pus cells, epithelial cells, no gonococci. Urine, glass 1 clear, shreds present.

*Treatment.*—Irrigations of urethra, nitrate of silver 1:10,000 to 1:4000.

(*a*) If relapse with gonococci follows, continue silver salt and astringent.

(*b*) If no relapse follows, irrigating dilatations with the Frank-Kollmann dilator or sound. Irrigations with nitrate of silver, ichthargan, or oxycyanide. Hand injections with astringent.

#### ANTERIOR URETHRITIS COMPLICATED BY POSTERIOR URETHRITIS

(*a*) Subacute form.

(*b*) Severe form.

(*a*) *Subacute Form.*—Symptoms almost unnoticeable. Urine, glass 1 turbid, glass 2 turbid. Suspect prostatitis.

*Treatment.*—Sandal oil internally. Irrigation, albargin or nitrate of silver, or instillations of nitrate of silver.

(*b*) *Severe Form.*—Symptoms, fever, tenesmus, terminal hematuria, and pyuria. Urine, glass 1 turbid, glass 2 turbid, possibly blood. Suspect prostatitis and vesiculitis.

*Treatment.*—Rest in bed, milk diet. Sandal oil or sodium salicylate and opium. Hot sitz-baths. Hot-water irrigation of rectum. No instrumentation or injections.

# CHAPTER XIV

## COMPLICATIONS OF ACUTE GONORRHEA

**Peracute Urethritis.**—In a few cases of gonorrhea the inflammatory symptoms run very high.

The prepuce and skin of the penis are red, inflamed, and very much swollen. The discharge is profuse, the burning on urination is intense and painful, erections are frequent and difficult to control.

In such cases all local treatment by injections and irrigations is absolutely contraindicated.

The patient should be put to bed, kept on a restricted diet, and lead and opium wash applied to the penis.

The expectant treatment is continued until the severity of the symptoms has abated and the case has assumed the characteristics of an ordinary gonorrhea, when it may be treated in the usual way.

**Severe burning on urination** is a source of great discomfort to the patient.

It may be moderated often by the administration of sandalwood oil. When this fails, the patient should drink freely of mucilaginous drinks, such as flaxseed tea or infusion of uva ursi.

Wossidlo recommends that limited quantities of water should be drunk, in order to lessen the volume of urine.

A 2 per cent solution of eucaine may also be injected into the urethra before urinating.

**Retention of urine** may arise as the result of the congestion occurring about an old stricture and closing its lumen entirely, or it may be due to a spasmodic contraction of the cut-off muscle, or a complicating prostatitis.

Retention is frequently relieved by the administration of a full dose of opium and a prolonged hot bath, but when these measures fail it is necessary to introduce a catheter, after first washing the urethra most carefully with albargin solution, 1:1000, to rid it of pus and prevent infection of the bladder.

**Balanitis** is an inflammation of the mucous membrane of the prepuce and glans penis, and is apt to occur in men with a long foreskin, and particularly in persons of uncleanly habits.

The *treatment* consists in cleanliness, the use of a dusting pow

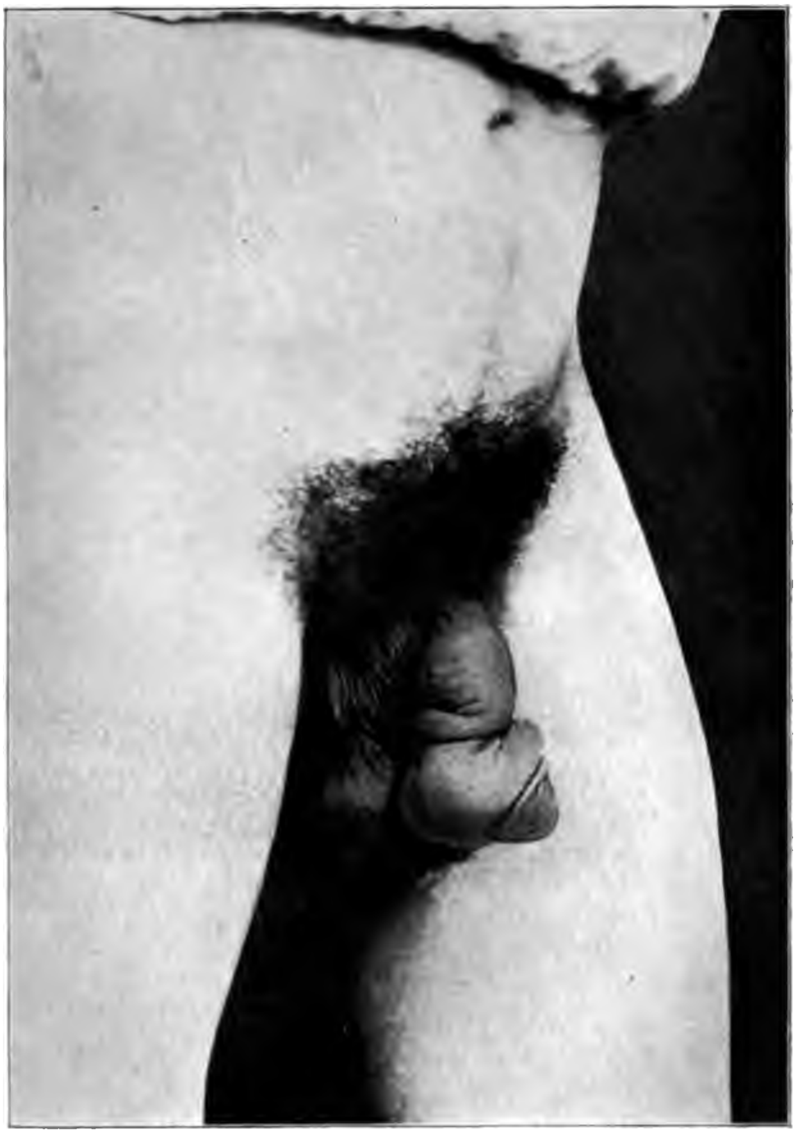
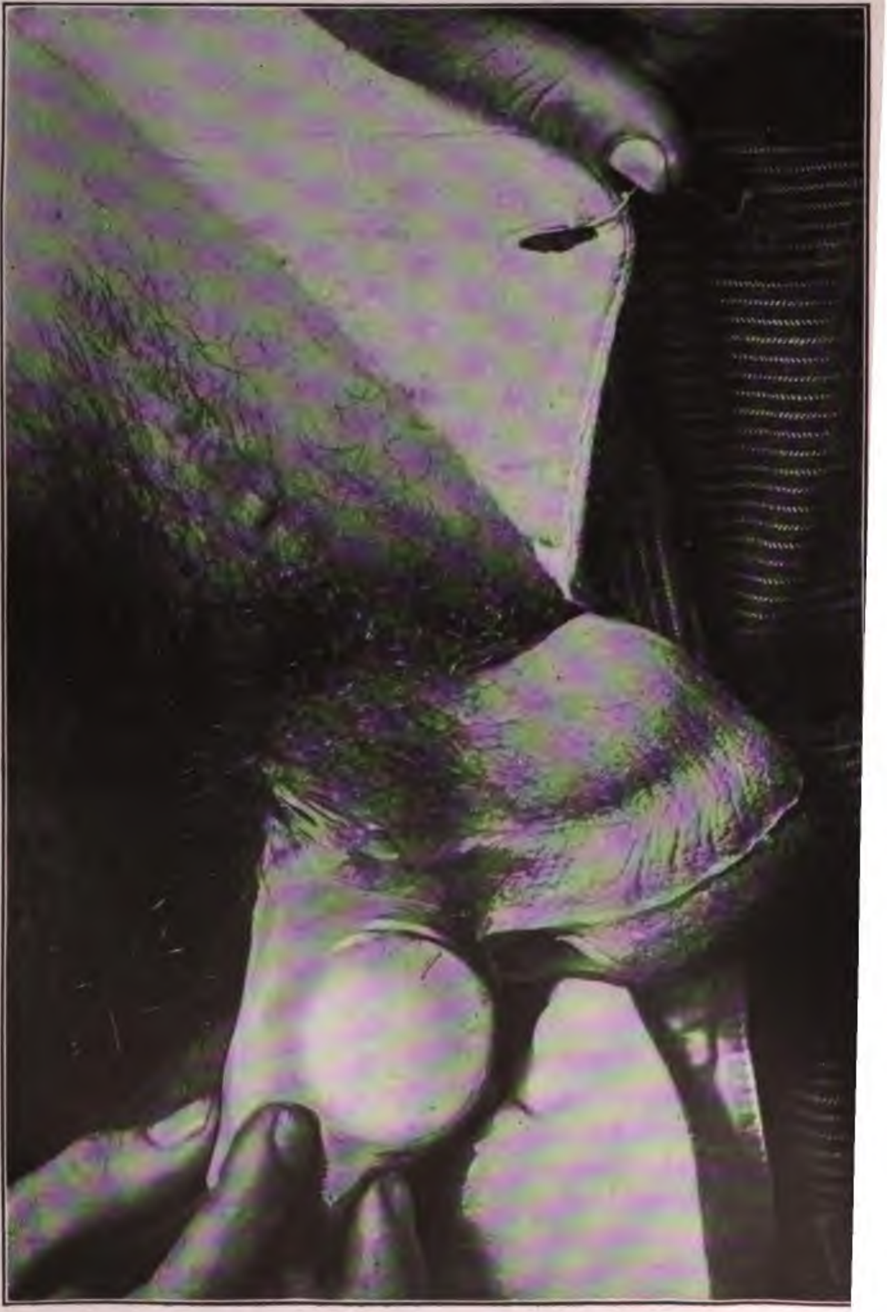


Fig 7[illegible]. Paraphimosis complicating gonorrhea.

der, and preventing contact of the apposing surfaces of mucous membrane by means of cotton packed between the foreskin and the glans. Occasionally the edema and swellings are so great that the foreskin can not be retracted, giving rise to a condition of phimosis.

**Phimosis.** This should be treated by prolonged soaking of the



penis in hot water and the use of an antiseptic injection thrown in under the foreskin with a flat-billed Taylor syringe. In the event of gangrene threatening or when the swelling and edema persist, the operation of circumcision or making an incision through the foreskin upon its dorsum is called for. If chancroids are found under the prepuce after operation, they should be cauterized as well as the freshly made wound.

**Paraphimosis** is that condition in which a long and tight foreskin is caught back behind the glans and can not be retracted over the head of the penis.

The *treatment* consists in bringing the foreskin back into its proper place by manipulation. If this proves difficult or if the glans looks gangrenous, the constricting band should be incised on the dorsum, which will generally allow reduction to be effected.

**Folliculitis** consists in suppuration of one of the urethral follicles, with retention of the pus, forming a small abscess, which, if left to itself, opens spontaneously either into the urethra or through the skin.

The *treatment* consists in laying the abscess cavity open freely, as soon as fluctuation is noticed, evacuating the pus, and allowing it to heal by granulation.

**Cowperitis** is a suppurative inflammation of Cowper's glands, and should be treated in the same way as folliculitis.

**Inguinal adenitis** is an inflammatory enlargement of the lymphatic glands in the groin, which is generally present in gonorrhea. The glands rarely suppurate, but usually undergo resolution.

The *treatment* consists in rest, hot or cold applications, and pressure. If suppuration occurs, it should be treated as a bubo. (See Bubo.)

**Chordee** is a complication which adds greatly to the discomfort of a patient with gonorrhea. It is due to the plastic infiltration which takes place into the meshes of the corpus spongiosum, and renders it so rigid and inelastic that it can not become elongated during erection, but draws on the corpora cavernosa, and bends them down, like the tightened string bends a bow.

*Treatment* is directed toward preventing these painful erections and allowing the patient to sleep undisturbed. To this end he should use prolonged immersions of the penis in very hot water before going to bed, and should sleep in a cool room, lightly covered. It is better for him to sleep on the side, as the dorsal decubitus favors congestion of the center of erection in the cord.

A towel tied around the waist with a knot in the middle of the back will assist in this, for if the patient lies on his back the knot will press into the flesh and waken him.

In severe cases these measures are not enough, and it is necessary to administer sedative drugs. Lupulin, gr. xxx-xl at bedtime; bromide of potash in large doses, 30 grains in the afternoon and again at bedtime, or monobromide of camphor in 5-grain doses will sometimes answer, and, when they do not, opium must be used, preferably by suppository.

When the patient wakes with the penis erect and painful, he should immerse both penis and testicles in a basin of hot water, or, if that is not at hand, cold water will answer the same purpose, and he should also empty his bladder.

"Breaking the chordee" leads to violent hemorrhage and ultimately to severe traumatic stricture.

**Epididymitis,** or inflammation of the epididymis, is not a result of metastasis through the blood vessels or lymph channels, but is caused by the passage of gonococci from the posterior urethra to the epididymis by way of the seminal vesicles and vas deferens.

The body of the testicle proper is not involved, as a rule, and the inflammation is limited to the epididymis, but the testicle is often *apparently* enlarged on account of its being surrounded by the swollen and inflamed epididymis. Another element which causes the testicle to appear larger than normal is the effusion of serum which takes place into the sac of the tunica vaginalis, and causes hydrocele. This may, in time, be absorbed or remain permanently and increase.

The *symptoms* are always well marked. There is severe pain in the testicle, radiating up into the abdomen. The patient's gait is characteristic; he bends over as he stands, and walks with his legs straddling in order to relax the spermatic cord and relieve it from the weight of the enlarged testicle.

The purulent discharge of the gonorrhea generally ceases at once, and remains absent until the inflammation in the epididymis is better, and then the discharge begins again, only not so profusely as before.

On examining the testicle we find the epididymis enlarged, hard, and tender, and the testicles can not be readily outlined on account of the effusion of serum into the sac of the tunica vaginalis. The spermatic cord is thickened and very tender. The inflammatory products disappear by resolution and rarely suppurate.

If both epididymes have been affected, a condition of *sterility* may be left, which is permanent. The function of the testicle may be destroyed in three ways:

I. The most common is the formation of an inflammatory infiltrate in the head of the epididymis, which is not absorbed, but remains and forms a plug, blocking up the efferent duct.

II. An atrophy of the glandular structure of the testicle may occur, probably as a result of inflammatory products in its substance.

III. In very exceptional cases the body of the testicle suppurates and sloughs out, and in this way the organ itself may be entirely destroyed.

Tuberculous disease of the testicle occasionally follows a gonorrheal epididymitis, and is due to the lighting up of a focus of tubercular material which had been unsuspected and dormant in the epididymis.

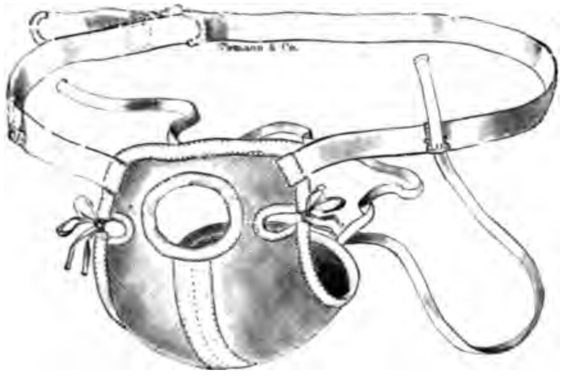


Fig. 81.—Horand-Langlebert suspensory bandage.

*Treatment.*—If seen within the first few hours the severity of the inflammation may be lessened by applying three or four leeches along the spermatic cord. The patient should, of course, be put in bed and the testicles supported by means of a Curling handkerchief bandage.

Hot applications are to be preferred rather than the ice bag, although ice was at one time very popular. While the ice subdues the inflammatory symptoms promptly, its use is very apt to be followed by a hard, tough infiltration in the epididymis, which is never absorbed, but remains, blocking up the epididymis and causing sterility. Another disadvantage of ice is that atrophy of the testicle is more apt to occur in cases where it has been used.

The hot applications can be used in the form of hot lead-and-opium wash or flaxseed poultices.

A favorite treatment in France consists in applying a salve to the inflamed testicle, composed of:

℞ Guaiacol ...................... 20 per cent
Lanolin,
Resorbin ..................... equal parts

This should be covered with cotton, with a layer of wax-paper or oil-silk on the outside. A thermophore, hot-water bag, or hot fomentations are then applied outside the dressing.

The guaiacol ointment usually allays the pain promptly and should be changed three times a day. At the time of changing the dressing the patient should take a hot sitz-bath for half an hour. The guaiacol ointment should be continued as long as the pain lasts, and after the skin is eroded it should be brushed over with nitrate-of-silver solution, 10 per cent, and dressed with fluidext. hamamelis.

Severe cases may be treated advantageously with peat fomentations and the pain may be relieved by antipyrin or morphine.

The bowels should be kept freely open by salts and an enema given every morning. Under this treatment it is said that a hard mass does not remain unabsorbed in the epididymis, causing sterility.

In cases where a great deal of effusion has taken place into the cavity of the tunica vaginalis, it is desirable to relieve the tension promptly by drawing off the fluid with an aspirating needle.

In cases of epididymitis which are not very severe, the Horand-Langlebert suspensory bandage, lined with a thick pad of cotton-batting, fills the indications of rest, warmth, and suspension, and at the same time permits the patient to walk about without pain.

After the patient is out of bed and begins to go about, he should continue the use of the suspensory bandage, and keep the testicle well enveloped in cotton.

It is the custom to use ointments designed to stimulate absorption. The one which is most commonly employed is:

℞ Ichthyol ............................... ʒj
Lanolin,
Vaselin ...............................āā ʒss
M. Sig.: To be applied constantly on lint to testicle.

Iodide of potash given internally is of no use in producing absorption of the inflammatory products.

The *Paquelin cautery* is sometimes used by brushing it lightly over the surface of the skin of the scrotum and burning or searing it very superficially. In the beginning of the disease it has the effect of allaying pain, and later on produces absorption of the inflammatory products.

In order to prevent sterility it is important to *promote the absorption of the newly formed tissue in the epididymis.*

In recent cases while the infiltrate is soft this may be accomplished by a sort of massage or kneading of the infiltration between the thumb and finger; but in cases of long standing, when the infiltration has become hard and dense, all such attempts are unsuccessful.

At the time that the zinc salts were used as injections in gonorrhea it was the practice to stop local treatment as soon as epididymitis developed, and not begin again until it was entirely cured.

Since the introduction of the silver salts, however, this rule no longer absolutely applies, and in cases where the inflammation is not too severe, the urethral injections of albargin or protargol may be continued without cessation, even though the testicle is swollen. (Frank.)

In order to prevent the development of an epididymitis in cases of chronic gonorrhea or enlarged prostate, after instrumentation of the urethra or massage of the prostate, Frank advises a thorough irrigation of the urethra before and after instrumentation, in order to rid the canal of organisms which may otherwise make their way through the ejaculatory ducts and vas deferens to the epididymis.

By following this plan he finds a marked diminution in the number of cases which develop in the course of treatment.

**Treatment of Gonorrheal Epididymitis by Surgical Operation.**—The great majority of cases of inflammation of the epididymis, due to extension of the gonorrheal inflammation from the urethra through the vasa deferentia, go on to more or less complete resolution under an expectant treatment. The resolution, unfortunately, is often not complete, and a deposit of fibrous tissue is left at the head of the epididymis which compresses its tubules, blocking the passages and preventing the exit of the spermatozoa which are formed in the testicle. In consequence, sterility of the testicle on that side results, and in case of a double epididymitis complete sterility is often the outcome.

While the pain in most cases of gonorrheal epididymitis is usually controlled by hot applications and rest in bed, it is not very unusual to meet with a case where the inflammatory reaction is so severe that in spite of large doses of opium the pain is unbearable. The temperature runs to 103° or higher, and, while the inflammation gradually subsides after a period of great suffering for the patient, the subsequent function of the testicle on the affected side is usually permanently destroyed.

It is to this class of severe inflammation of the epididymis that the operation about to be described is applicable.

The treatment of gonorrheal epididymitis by incision and puncture is by no means a new idea. It was done by Pirogoff in 1852, and also by Vidal de Cassis, and, in 1864, H. Smith reported in the *Lancet* one thousand cases of epididymitis treated in this way.

The operative treatment seems then to have fallen into entire disuse, except in cases where a considerable quantity of fluid accumulated in the sac of the tunica vaginalis. In these acute hydroceles it has been customary to aspirate or draw off the fluid with a trocar, and the relief of the tension was always followed by great lessening of the pain.

To Francis R. Hagner,[1] of Washington, belongs the credit of developing and applying the operation which, in his hands and that of the writer, has lessened the severity and shortened the course and probably preserved the integrity of the testicle in the severest forms of gonorrheal epididymitis.

As before stated, it is necessary only in the most exceptional cases, where the pain is excessive and the temperature runs high; the others are amenable to ordinary medical treatment.

The operation is performed as follows:

The patient is prepared for a major operation and then anesthetized. The use of cocaine is not practicable because of the pain occasioned in handling the parts after the initial steps.

An incision is made through the skin of the scrotum, exposing the tunica vaginalis, which is opened at the junction of the epididymis and testicle. The fluid contained is evacuated, and the enlarged epididymis examined through the wound. The testicle and epididymis are delivered through the wound and enveloped in warm towels. Multiple punctures are made through the fibrous covering of the epididymis with a tenotome, especially over the portions where the enlargement and thickening is greatest. The knife should penetrate the thickened fibrous capsule and enter the infiltrated connective tissue; a decided lessening of resistance is felt after the knife has penetrated the thickened covering of the epididymis.

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[1] Transactions American Association of Genito-urinary Surgeons, 1907.

If pus is seen escaping from any of the punctures, the opening should be enlarged and a small probe inserted in the direction from which the pus flows. The insertion of a probe is attended with less danger of injuring the tubes of the epididymis than if a knife were used.

After the small abscess has been explored with a probe, the pus should be evacuated by light pressure over its surface, and its cavity washed out with a fine-pointed syringe and a solution of bichloride of mercury, 1:1000, followed by a normal salt solution.

The incision in the tunica vaginalis should be lightly closed with a running catgut suture; a cigarette drain of gauze is then applied over the incision, and the skin brought together by a subcutaneous suture. Gauze dressings are applied and the part supported by a wide T-bandage.

The second day after the operation the gauze drain is removed and the wound redressed, and, as a rule, the patient is allowed to get out of bed and walk about a week after the operation.

In several of the cases the writer operated upon, the testicle and sac, instead of being freely movable, were bound firmly to the scrotum by means of firm, newly formed adhesions.

Invariably the sac of the tunica vaginalis has been filled with enough fluid to cause a good deal of distention.

In one case there was but little free fluid, the entire sac being filled with a sort of false membrane or effusion of plastic lymph.

The spermatic cord was thickened and the epididymis very much enlarged, more especially at the head. The engorged vessels could be seen coursing over the epididymis, and its color was of a dark purple; occasionally the pressure from the distention was so great that a white bloodless area the size of a finger-nail could be seen at its extremity.

In four instances collections of pus, two of which contained gonococci, were found in puncturing the epididymis.

The finding and evacuation of collections of pus in the epididymis is a sufficient warrant for the performance of an operation, for it is only following out the surgical axiom of giving free vent to collections of pus which are closed up. The operation also clears up an erroneous impression which has prevailed, to the effect that gonorrheal epididymitis did not suppurate and only caused an adhesive inflammation.

In the 7 cases operated upon by the writer the pain was relieved at once and was never felt again. A drop in the temperature almost to the normal point occurred immediately, and the temperature soon became normal and remained there.

In all the cases but 2 the patient was able to get out of bed and walk about the ward, without discomfort, in one week's time.

The time required for an entire return of the testicle to its normal size, and the disappearance of all traces of infiltrate in the head of the epididymis, varied considerably. Two cases were lost sight of, but with the others it required, respectively, five, six, eight, and ten weeks for the parts to be entirely restored to normal conditions; but it must be remembered that these cases were all exceptionally severe, and that resolution would have been still more delayed under an expectant plan of treatment.

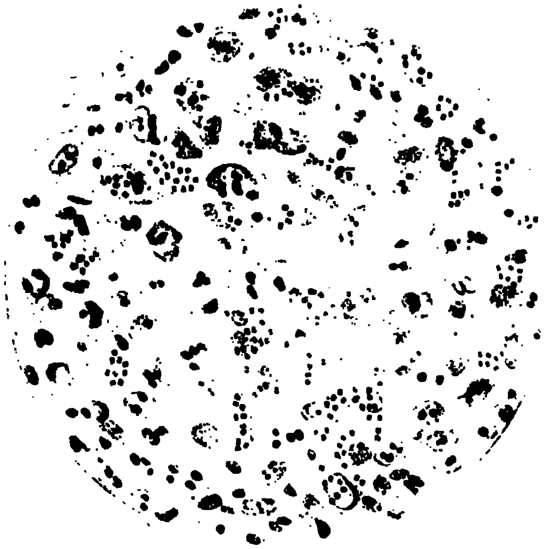

Fig. 82.—Gonorrheal rheumatism. Synovial membrane infiltrated with numerous intracellular gonococci. (From "Die Syphilis und die Venerischen Krankheiten," by Dr. Ernest Finger.)

**Gonorrheal rheumatism** is an inflammation of one or more joints occurring in the course of a gonorrhea and due to the direct action of the gonococcus. The gonococci are carried through the blood current, and are deposited in various joints, where they set up an inflammation in the synovial membrane lining them.

If the gonococci alone are deposited in the joint, the resulting inflammation causes an excessive secretion of serum, and a simple *hydrarthrosis* results, or the inflammation may attack the synovial sheaths of tendons and the bursæ, occasioning a chronic thickening, with ankylosis of the joints from the formation of connective tissue. These can not be successfully operated upon afterward, and the joint remains permanently stiffened.

*Suppurative* inflammations of the joint are due to a mixed infection; in addition to the gonococci, staphylococci and streptococci are the exciting causes.

Clinically we can distinguish three forms of gonorrheal rheumatism:

(*a*) *Hydrarthrosis*, which is usually confined to a single joint (monarticular), and is generally the knee.

(*b*) Resembling ordinary rheumatism, since it begins with fever, and several joints are involved.

(*c*) The synovial sheaths of tendons and muscles and the bursæ are attacked and become the seat of chronic inflammatory changes. The joints may be involved or may escape.

The course of all forms is very slow, and recovery is always protracted.

Pericarditis and endocarditis also frequently occur, with ulcerations of the valves and the formation of deposits upon them, which contain gonococci.

*Treatment.*—It is of essential importance to treat the gonorrhea, which almost always affects the posterior urethra or its adnexa.

In the cases which begin with active symptoms—high fever, rapid pulse, and the affection of several joints—salicylate of soda acts well, but in a case which is insidious in its beginning and turns out to be a slow, chronic synovitis, giving rise to hydrarthrosis, the salicylates are of little use.

Iodide of potash given in increasingly large doses, even as high as 3 or 4 drams a day, is sometimes of more benefit than anything else. Salol and oil of gaultheria are also sometimes of use.

The *local treatment* is important. The inflamed joint should be put at rest by keeping the patient in bed and applying a light splint to immobilize it. If much heat, redness, and swelling are present, an evaporating lotion or an ice bag is in order.

In the last few years two valuable therapeutic measures have been introduced into practice, viz., Bier's hyperemia and the vaccine therapy.

The **Bier hyperemia treatment** is based upon the physiologic point of view that an inflammation in itself does not represent a diseased condition, but is a phenomenon showing the body's attempt to resist a deleterious invasion.

The aim of the Bier hyperemic treatment is to increase this beneficent inflammatory hyperemia resulting from the fight of the living body against invasion.

The most important principle underlying the treatment is that the blood must continue to circulate; there must never be a stasis.

As soon as the diagnosis of gonorrheal arthritis is made, the hyperemia treatment should be begun, and, the earlier the treatment is started, the better is the result.

*Method of Application.*—Obstructive hyperemia of the extremities is produced by means of a soft-rubber bandage two and a half inches wide applied around the limb, on healthy tissue, proximal to the seat of disease after all dressings have been removed, six or eight times, one layer overlapping the other firmly enough to strictly constrict the lumen of the thin-walled veins, but not sufficiently to compress the more resistant arteries.

The shoulder, however, can be made hyperemic by means of the following special technic (Willy Meyer): A compress of gauze is folded and tied loosely around the patient's neck. Through its loop a piece of strong rubber tubing is pushed and conducted underneath the axilla around the shoulder. Then the tubing is clamped or tied on top of the shoulder, a piece of bandage is tied on to the rubber tubing—one in front, another behind—the two ends being joined in the opposite axilla.

If a marked degree of venous congestion is desired, the bandage is applied rather tightly; if, on the other hand, only a slight congestion is desired, the bandage is applied so that only a slight amount of pressure is exerted. If the bandage is applied about the limit snugly to produce a marked hyperemia, the limb within a few minutes shows signs of venous congestion: it feels fuller, the veins stand out, and the skin becomes bluish. Hyperemia of this marked degree is never borne, with comfort, for more than one to two hours at a time. If, however, one desires a much milder hyperemia the bandage is applied less snugly and the parts show less engorgement. Now the limb becomes, instead of bright blue, a bright red or at times tinged with blue. This form of bandage may be worn with comfort by the patient for the greater part o the day.

**Edema.**—With both methods of application, the parts becom edematous. With the milder method the swelling is more marked

This edema has to be kept within proper limits, and be reduced before the reapplication of the bandage. For this reason the treatment for the twenty-four hours is divided into two periods. During the intermission, following the application of the bandage for short periods, one to two hours, the edema always becomes absorbed. However, in cases of long-continued hyperemia ten to eleven hours, out of every twelve, in which, therefore, the time for absorption is short, the extremity should be elevated.

In acutely infected cases the rapid absorption of the inflammatory edema is often followed by some elevation of temperature which is of short duration.

Duration of Treatment.—Acute cases require prolonged applications of the bandage, with the milder degree of venous obstruction. Usually two periods in twenty-four hours, of five to eleven hours each, depending upon the acuteness and severity of the disease is the practice.

Chronic cases require shorter periods of treatment. Usually two periods in twenty-four hours of one to two hours each is enough.

Passive motion is started as soon as lessening in the amount of pain will permit. This method of treatment has been so successful in the treatment of gonorrheal rheumatism in the Long Island College and Kings County Hospitals that it is now used as a routine.

With a correct technic the pain present in an acutely infected joint will be relieved in a few hours.

It has been observed that the first application is not as well borne as the succeeding one, due to the tendency to make the bandage too tight. The patient's own feelings are the best guide, for the degree of obstructed hyperemia (mild type) is a correct one, if the patient is not in the least annoyed by the bandage applied. As soon as the latter unduly contracts, paresthesia will be noticed in the part subjected to hyperemia; then pain sets in. If applied too loosely a mere obstruction to the return of lymph is produced. the accumulation of which alone is not wanted. The portion distal to the bandage must appear bluish or bluish red, never white; always warm, never cold.

**The gonococcus vaccine** has in this class of cases its greatest field of usefulness, and should be used in connection with the Bier hyperemia.

An autogenous vaccine may be prepared, but it is simpler to use a stock vaccine from some reliable maker. Fifty million bacteria may be injected subcutaneously as an initial dose. Usually there is but little reaction in the way of rise of temperature, and for the subsequent doses, which may be repeated three times a week, the full dose at one hundred million bacteria may be used.

Under the continued effects of the Bier hyperemia and the vaccines, in the course of a few days the pain is relieved and the case becomes chronic. The treatment with the vaccines and the hyperemia should still be continued, but the clinical picture has changed and the special indications for treatment at this stage are:—

I. *To produce absorption of the watery effusion in the joint.*

The most powerful agent, to this end, is *blistering,* and it should be applied on different parts of the skin over the joint, and used often enough to keep the surface raw for a considerable length of time.

Ichthyol ointment, of 50 per cent strength, is sometimes useful as an absorbent. In all chronic cases when the patient walks about *pressure* over the joint by means of a rubber bandage should be applied, and this may serve as a substitute for blistering when the amount of fluid is slight.

It was formerly recommended, when in spite of treatment the fluid did not disappear, to aspirate the joint, draw off the fluid, and irrigate with a solution of bichloride of mercury. This plan of treatment can only be condemned, as the risk of causing a permanently ankylosed knee-joint is too great to warrant the procedure.

After the effusion in the joint has been absorbed, or in those cases where the disease has attacked the synovial sheaths and fibrous structures about the joints, the indication is:

II. *To cause absorption of the inflammatory deposit, which has taken around the bursæ, tendons, and synovial sheaths.*

This can be best accomplished by massage, which should be begun as soon as the patient can tolerate it, and the massage may be assisted by douching or spraying with hot and cold water alternately.

Many chronic cases of gonorrheal rheumatism are benefited by the hot-air treatment, applied by placing the joint in a hot-air box and raising the temperature from 175° to 210° for from half an hour to an hour at a time.

After removal from the oven the limb is seen to be covered with perspiration and must be gently wiped and wrapped in flannel so as to avoid a chill.

The baking may be associated with advantage with massage in the chronic cases.

In the treatment of gonorrheal rheumatism, it is important to begin active treatment early, for if not treated energetically at first it becomes chronic and is very difficult to cure.

It is also of essential importance to treat the gonorrhea, which has become chronic and frequently has involved the prostate and vesicles and in every case of gonorrheal rheumatism these organs should be carefully examined and treated if diseased for treatment directed to the joints will never cure a case in which gonococci are passing into the blood from a chronic inflammation of the prostate or vesicles.

It is in cases of this sort that the operation of seminal vesiculotomy and drainage of the vesicles sometimes accomplishes a cure when all local treatment has failed.

# CHAPTER XV

## CHRONIC URETHRITIS

Chronic urethritis is one of the most obstinate and difficult affections to cure, which the genitourinary specialist is called upon to treat, unless the treatment is based upon a knowledge of the pathological changes which have taken place in the tissues, and the character and exact location in the urethra of the lesions.

A case of gonorrhea may be called chronic when it has lasted for ten or twelve weeks.

Chronic urethritis is sometimes incorrectly called *"gleet,"* but the true definition of gleet is: *A chronic mucopurulent discharge produced in certain localized areas of the mucous membrane of the urethra which are in a state of chronic catarrhal or granular inflammation.*

The statement that every case of gleet is dependent upon a stricture is an incorrect one. A gleety discharge may be occasioned by superficial changes in the mucous membrane, which never produce any narrowing of the urethra. On the other hand, in cases where stricture does exist, the mucous membrane lying above is never healthy, and a gleety discharge is always present.

The **predisposing causes** of the chronic urethritis may be summed up as follows: Anything which tends to prolong or prevent the natural healing of a gonorrhea, such as: (*a*) Careless ways of living on the part of the patient. (*b*) Injections which are too strong or used too frequently. (*c*) Use of alcohol or beer. (*d*) Sexual intercourse or erotic excitement.

At other times, cases which are properly treated and which have had good care become chronic, usually on account of some diathetic taint, either tuberculosis, rheumatism, gout, or sometimes incipient pulmonary phthisis.

It is convenient to study chronic inflammation of the *anterior* urethra by itself, although the posterior urethra is apt to be affected as well, at the same time.

# CHRONIC ANTERIOR URETHRITIS

## Pathology

As a result of gonorrhea, particularly in its later stages, an *infiltration of small round cells* takes place. This infiltration is the most important characteristic of the disease, and most of the other changes in the tissues result from it. The small round cells originate partly from the capillary vessels of the mucosa and partly from a proliferation of the fixed connective-tissue cells.

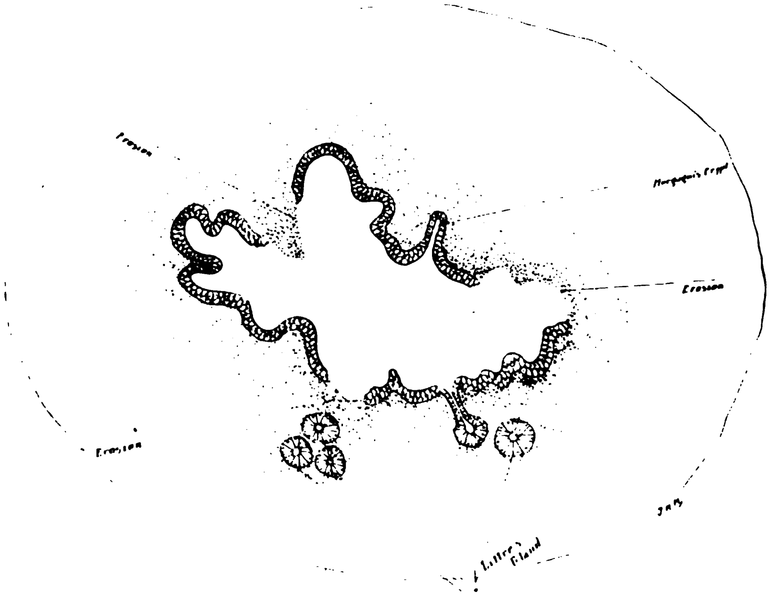

Fig. 83.—Diagram of a cross section of the urethra, representing the histologic changes in chronic urethritis.

The small round-celled infiltration begins in the submucous connective tissue and surrounds the lumen of the urethra completely.

Its favorite points of location are most frequently around the bulbous urethra, and next in frequency at the fossa navicularis. These are the widest and most dilatable portions of the canal, and in acute gonorrhea the stream of urine is not sufficient to wash out the pus, which stagnates here and acts as a focus for the renewed local infection of the tissues at these points.

The mucous glands and follicles (Littré's glands and Morgagni's crypts), which dip down into the meshes of the corpus spongiosum are also surrounded by and imbedded in the infiltration.

Clinically we may classify the cases of chronic urethritis according to the extent of the infiltration into: (*a*) *superficial,* or *mucous. form,* in which the small round-celled infiltration is confined to the mucous membrane, subepithelial connective tissue and periglandular tissue alone, and which is not followed by stricture, and (*b*) the *deep form* of infiltration.

In the latter class the infiltration extends *deeply* into the tissues, and involves the meshes of the corpus spongiosum extensively and is always followed by stricture.

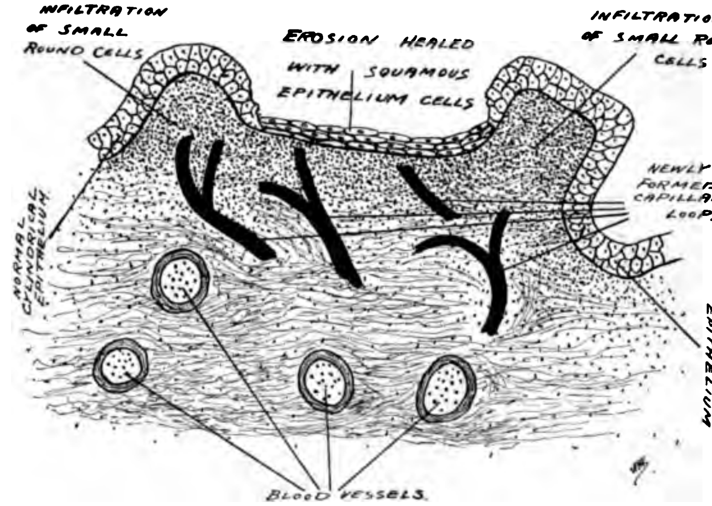
INFILTRATION OF SMALL ROUND CELLS
EROSION HEALED WITH SQUAMOUS EPITHELIUM CELLS
INFILTRATION OF SMALL ROUND CELLS
NEWLY FORMED CAPILLARY LOOPS
NORMAL CYLINDRICAL EPITHELIUM
NORMAL CYLINDRICAL EPITHELIUM
BLOOD VESSELS.

Fig. 84.—Diagram of a section of the urethra, representing the histologic changes in the formation of a granular patch in chronic urethritis.

**Glandular Changes.**—During the course of the gonorrhea the gonococci penetrate into *Morgagni's crypts* and *Littré's glands* and set up an inflammation in the cavities, which is accompanied by an infiltration of small round cells *around* the ducts and walls of the glands (periglandular infiltration).

The infiltration around the duct stiffens it and keeps its mouth open and gaping, affording an open gateway for the escape of the inflammatory products which have formed within the cavity of the gland.

The gonococci may continue to propagate within the cavities of the glands for months after the inflammation has entirely ceased on the free surface of the mucous membrane.

The reappearance of an acute purulent discharge containing gonococci, a so-called *relapse,* is due to an escape of gonococci from the glands and a reinfection of the surface of the mucous membrane.

Infection of wives and mistresses with gonorrhea, during coitus, is often caused in the same way; viz., the escape of pus cells containing gonococci, which had been formed by the suppurative process continuing in the gland-cavities after the surface of the mucous membrane had been well for months. During intercourse the pus, mixed with seminal fluid, is deposited in the vagina of the female and infection follows.

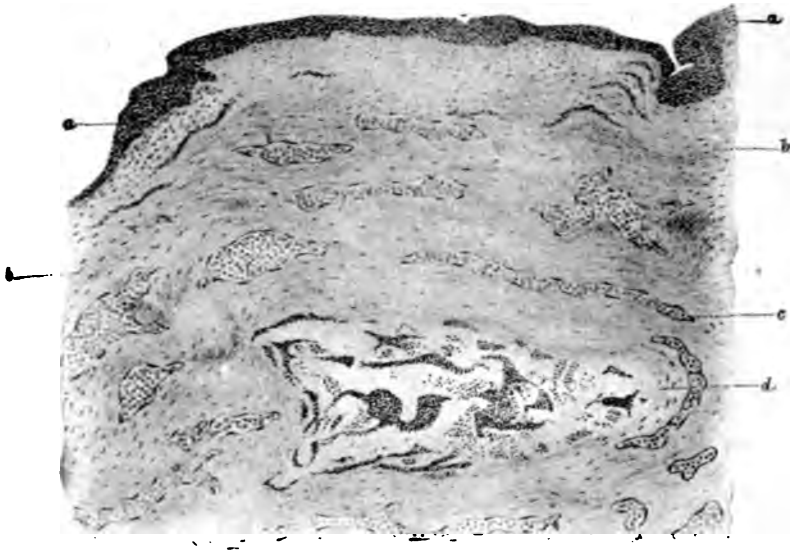

Fig. 85.—Beginning stricture. *a,* squamous epithelium in many layers; *b,* contracted connective tissue; *c,* contracted meshes of the corpus spongiosum; *d,* remains of Littré's gland, obliterated through contraction of the periglandular and interstitial connective tissue. (From "Die Syphilis und die Venerischen Krankheiten," by Dr. Ernest Finger.)

The inflammatory products, consisting of desquamated epithelial cells, pus cells, and granular material, which stuff the cavities of the glands, are washed out by the act of urination and appear floating about in the urine as shreds.

The small granules are probably formed in the glands of the anterior urethra, and the larger plugs, shaped like a comma or tadpole (Fürbringer's hooks), originate in the follicles of the prostatic urethra.

Larger "clap-shreds" are also always present, and are occasioned by the secretion from erosions drying upon the surface, forming a scab, which is washed away by the stream of urine.

**Changes in the Mucosa.**—During the acute inflammatory stage of a gonorrhea the cylindrical epithelium lining the urethra is loosened and thrown off in patches, leaving superficial *erosions.* These losses of epithelium, except in very rare instances, are not deep enough to deserve the name of ulcers.

On account of the round-celled infiltration of the submucous tissues the erosions do not heal readily, but remain uncovered by epithelium for a long time.

The blood vessels in the submucous tissues send up newly formed capillary loops, which traverse the infiltration in an upward direction, and as they grow toward the surface penetrate the floor of the erosion and convert it into a bed of newly formed *granulations.*

These "granular patches" resemble an ulcer in any part of the body after it has become covered with luxuriant florid granulations, which are composed purely of capillary loops, having no tendency to cicatrize and which are easily broken down and destroyed by slight force.

In other cases the mucous membrane is not eroded and there are no granular patches present: Instead of a loss of substance there is simply swelling, congestion, and edema of the mucous membrane, in scattered patches, occasioned by its being in a condition of chronic inflammation and infiltration with leucocytes.

These superficial changes in the mucous membrane occasion a continuous gleety discharge until they are healed.

**Final healing of the lesions** is brought about as follows:

When the small round-celled infiltration is first deposited, it is soft and succulent, and while in this state it may disappear, entirely or in part, by a process of *absorption.*

If absorption does not take place, the small, round, infiltrating cells become organized, and are replaced by true fibrous connective tissues of a low grade, which goes on to *contraction.*

In a case where the infiltration was of the *superficial,* or *mucous, form,* involving only the mucous membrane and surrounding the glands, stricture does not follow.

In the *deep* form of infiltration, however, which extends deeply into the periurethral tissues and involves the meshes of the corpus spongiosum extensively, the heavy masses of scar tissue, into which the infiltration becomes converted, contract, impair the dilatability or may materially decrease the caliber of the urethral canal, and form *stricture*.

After the infiltration which surrounded Morgagni's crypts and Littré's glands has been converted into scar tissue, its subsequent contraction squeezes the walls together; so that the glands are compressed and obliterated.

The granulations, which have formed upon the erosions, consist simply of capillary blood vessels, which have been given off from the submucous vessels and have penetrated the infiltration in an upward direction. After the formation of scar tissue its contraction squeezes the capillaries together and destroys them, and the granulations disappear as a result of strangulation.

The erosions become covered not with the normal cylindrical epithelium of the healthy portions of the mucous membrane, but by many layers of squamous epithelium.

The changes wrought by the conversion and contraction of the scar tissue require from two to ten years for their completion, and they do not proceed with a uniform degree of rapidity; so that, on examining a case, all gradations of the process may often be seen at the same time.

### Symptoms

There is an absence of any marked subjective symptoms; there may be at most an occasional tickling at the meatus.

The *discharge* from the urethra is mucopurulent, thin, and scanty, and is often so slight that there is only a drop in the morning or a sticking together of the lips of the meatus.

A common feature of chronic urethritis is the *exacerbations*, which are constantly occurring. The patient develops a profuse purulent discharge, which is checked very promptly by treatment.

As a result of various indiscretions, an acute inflammation is set up in the damaged portions of the urethra, and the discharge which is produced in them occasions a *reinfection* of healthy portions of the canal, as it passes over them.

When a considerable extent of surface of the mucous membrane is involved in the inflammatory process, if the patient passes his water into two glasses, the first glass is *turbid* from the quantity of pus washed out from the canal. On microscopic examination the discharge is found to be composed of pus cells, containing gonococci in profusion, desquamated epithelial cells, and mucus from crypts and follicles. After the inflammation is *localized*, and exists only in spots, the urine in the first glass is no longer turbid, but shows a few shreds floating in *clear* urine.

The presence of *shreds* always indicates that at some point along the urethra the mucous membrane is diseased, and a shred is simply the secretion, which forms a scab on the surface, and is washed off by the stream of urine. The form of lesion may be an erosion or granular patch or a chronic catarrh of the mucous membrane lying over an infiltration.

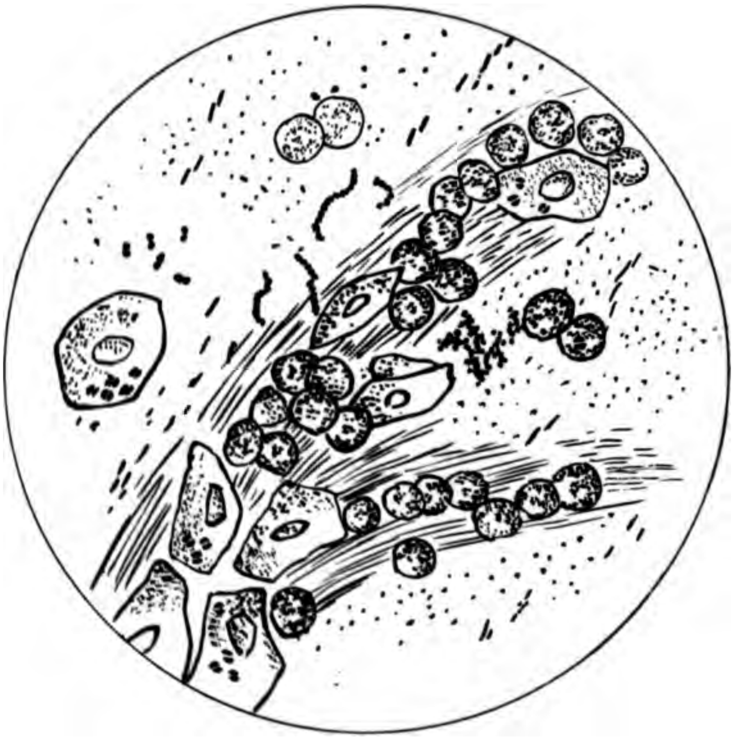

Fig. 80.—Shred from a case of gonorrhea of long standing. Mixed infection has occurred. The specimen shows desquamated squamous epithelial cells, with gonococci on their surfaces, pus cells, staphylococci, and streptococci arranged in chains.

Microscopic examination shows the *composition* of shreds to be pus cells, which may or may not contain gonococci, and desquamated epithelium, held together by a quantity of mucus.

In *shape* shreds present themselves as heavy flakes; long, slender filaments; tadpole-shaped bodies, or small granules. The heavy shreds always contain pus, and sink to the bottom, while the light filaments are composed entirely of squamous epithelial cells and float. The point of practical clinical importance to determine is whether the shreds are made up of pus cells containing gonococci, or whether they are composed of squamous epithelium alone, desquamated from the healed surface of a former lesion.

## Diagnosis

The points to determine in making the diagnosis of the conditions in chronic anterior urethritis are:

(*a*) Whether a considerable surface of the urethral mucous membrane is involved in the inflammatory process, and secreting pus freely. When this is the case it is indicated by a *turbid,* cloudy appearance of the first glass of urine, on making the two-glass test. Or

(*b*) Whether the inflammation is no longer general, but limited *to localized areas.* In the latter condition the first glass of urine will contain *shreds* floating in *clear* urine.

It is equally important to ascertain if:

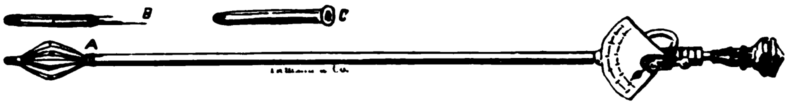

Fig. 87.—Otis urethrometer.

(*c*) The inflammatory process is *superficial;* that is, limited to the mucous membrane and glands; or if:

(*d*) The infiltration has involved the meshes of the corpus spongiosum, and commencing stricture is present. The instruments useful in settling points *c* and *d* are: (1) the Otis urethrometer, (2) the bulbous bougie, and (3) the endoscope.

**Otis Urethrometer.**—*Method of Using.*—The point of *greatest dilatability* of the normal urethra is at the bulb, and on withdrawing the urethrometer we find that the dilatability of the urethra is diminished *gradually* toward the meatus, except at the fossa navicularis. When a *deep* infiltration is present the dilatability of the urethra is diminished *abruptly,* but the urethral canal is freely dilatable both *before* and *behind* the infiltrated point.

On the other hand, *superficial* infiltrations involving only the mucous membrane do not extend into the deeper submucous tissues or meshes of corpus spongiosum and do not interfere with the dilatability of the urethral canal.

It is important to recognize deep infiltrations, while they are still soft and recent and before they have been converted with scar tissue, so as to bring about their *absorption* and prevent the formation of stricture.

**The bulbous bougie,** preferably the flexible variety, may be used for the same purpose, but is better adapted to recognizing infiltrations which have been transformed into scar tissue and have begun to contract.

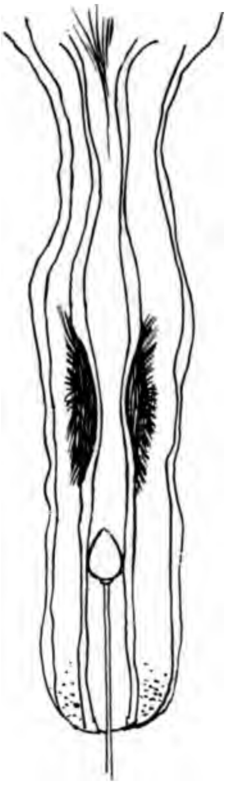

Fig. 88.—Diagram showing method of detecting deep infiltration in chronic urethritis, with bougie à boule or urethrometer.

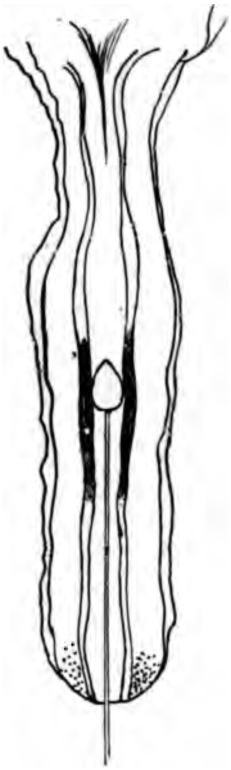

Fig. 89.—Diagram showing impossibility of recognizing superficial infiltration, involving mucous membrane alone, by means of bougie à boule or urethrometer.

**The use of the microscope** is as important in chronic urethritis as in the acute variety, for without its use the presence or absence of gonococci can not be determined.

In the cases, which are very frequent, where a mixed infection with other organisms has occurred, it is impossible to recognize them without the microscope.

It is also necessary in differentiating other urethral discharges from gonorrhea.

Fürbringer has described under the term *urethrorrhœa ex libidine* a discharge which occurs from the meatus in strong healthy individuals after prolonged erection without coitus and consisting of a white, glairy fluid.

Under the microscope this is found to be composed of scanty epithelial cells, a few scattered leucocytes, and mucus.

Prostatorrhea and spermatorrhea present such characteristic pictures under the microscope as to be easily differentiated.

To complete the examination of a case of chronic gonorrhea a **urethroscopic examination** should also be made, but to be of any value the surgeon attempting it should have had enough experience to recognize the conditions, and to learn to do this requires months of constant practice.

In many cases sufficient information for the appropriate treatment can be elicited by inspecting the urine, examining the discharge from the meatus with the microscope, and exploring the urethra with a bulbous bougie, but the cases of infection of Morgagni's crypts (glandular urethritis) can only be recognized and treated with the endoscope. The progressive healing and change in character of the epithelium under the treatment by dilatation can not be observed in any other way than by urethroscopic examination, and certain rare conditions, such as polypi or urethral granulations, can not be diagnosed, except by the use of this instrument.

In all cases, then, where the conditions do not seem to improve under treatment, a urethroscopic examination by a capable urologist should be made to revise the diagnosis.

## Treatment of Chronic Anterior Urethritis

To understand clearly the indications for treatment it may be desirable to recapitulate the forms which chronic urethritis assumes, using Finger's classification.

### Forms of Chronic Urethritis

I. *Recent cases*, in which an extensive surface is involved in a general catarrh.

I. *Cases of long standing which are more chronic*, in which, instead of a general inflammation, the process is localized in isolated spots. The disease may be

(*a*) *Superficial* and confined to the mucous membrane, or (*b*) *Deep* and in the submucous connective tissue, often complicated by

(*c*) Affections of the paraurethral glands.

In the cases of chronic urethritis of the **superficial variety**—that is, when the diseased condition is limited to the mucous membrane, and does not affect the deeper tissues—*the indications for treatment* are (*a*) to rid the tissues of gonococci (*b*) to cure the catarrhal inflammation so that only the deep foci remain; (*c*) to promote the formation of squamous epithelium to cover the erosions.

These indications are fulfilled by the local application of astringent and antiseptic solutions. When **general catarrh** of the mucous membrane is present, as indicated by turbidity of the first glass of urine, the patient may inject his urethra with an ordinary gonorrhea syringe, and gradually increase the strength of the injections. (For formulæ see "Acute Gonorrhea.") It is preferable, however, to use an *irrigator,* which has the advantage of distending the folds of mucous membrane and insuring a thorough contact of the solution with its entire surface.

A soft-rubber catheter, attached to a large-sized hard-rubber syringe holding 4 ounces, carried down into the bulbous urethra, may be used, but it is not as effective as the irrigator. (See Janet Irrigation.)

As long as microscopic examination shows the presence of gonococci, the best solution to use for irrigation is albargin, 1:1000. Under irrigations every day or every second day the pus disappears and the urine becomes clear, with a few shreds floating in it, and the gonococci are no longer to be found with the microscope.

Nitrate-of-silver irrigations, 1:10,000 to 1:4000, may be substituted for the albargin at this point. The appearance of a marked reaction with free suppuration and gonococci after the nitrate of silver denotes that a focus of gonococci had been opened up and a reinfection of the tissues caused.

If no reaction follows, the nitrate-of-silver irrigations may be continued, until no further improvement is noticed and the case is at a standstill.

The process at this time has ceased to be general and is confined to isolated spots, and on examining the urine it is found no longer to be turbid from admixture with pus, but *clear and with numerous shreds* floating in it. The presence of clear urine containing shreds is regarded as an indication for substituting stronger applications to the diseased spots than can be used by irrigation.

The best means of applying strong astringents to the isolated foci are by means of (*a*) the Ultzmann brush apparatus, and (*b*) instillations with an Ultzmann or Guyon syringe.

**The Ultzmann Brush Apparatus.**—This istrument is particularly adapted to the treatment of old foci of inflammation which are located in the bulbous dilatation of the urethra, accompanied perhaps by a few scattered areas along the anterior urethra.

If the instrument is introduced and the entire anterior urethra is brushed over, by a combined rotary and withdrawing motion of the brush, with a solution of nitrate of silver from 15 to 25 grains to the ounce in strength, and examined immediately afterward with the endoscope, the diseased spots will be seen to be colored a whitish gray, while the healthy portions of mucous membrane will appear unaltered by the nitrate of silver. In this way the growth of epithelium is stimulated over the eroded spots.

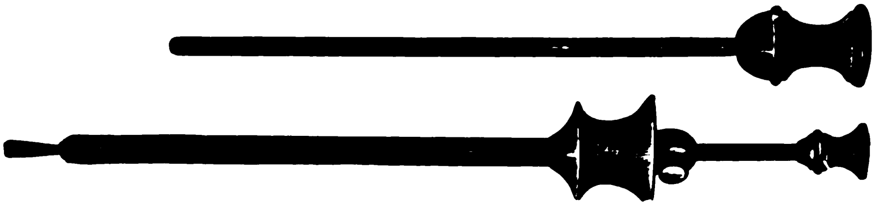

Fig. 90.—Ultzmann's brush apparatus. (Kny-Scheerer Company.)

Particular attention should be given to the bulb, brushing it out first with water to remove the adherent secretion, subsequently *twice* with the medicament. Instead of nitrate of silver, Frank advises using a solution of lactate of copper, 2 per cent., in glycerin, applied every second day.

**Instillations.**—By means of Guyon's or Ultzmann's syringe concentrated solutions of nitrate of silver can be deposited, drop by drop, along the whole length of the urethra, from the vesical sphincter to the meatus, thus bringing the medicament in contact with healthy and diseased portions alike.

The patient may be allowed to use a mild astringent injection, upon the days when no instillation is made.

During the course of the treatment *exacerbations*, accompanied by vesical tenesmus, free suppuration, and turbidity of both glasses of urine, occur at times. When these happen, the instillations must, of course, be suspended and either sandalwood oil or salicylate of soda given by the mouth, or, if the exacerbation is not very severe, the case may be treated by irrigations until the urine is again free from pus, when the instillations may be resumed.

It is very exceptional for the diseased foci to be so isolated that they can be treated in any other way, even through the endoscope.

The indication for the use of instillations of nitrate of silver is considered to be the *presence of clap shreds floating in clear urine.*

In a case coming under treatment, however, for the first time, instillations should never be used until the effect of irrigations has been tried, for the treatment of chronic gonorrhea is founded upon the principle of beginning with mild applications and gradually proceeding to the use of stronger and more irritating measures.

Another point to bear in mind is the fact that the irritation caused by the application of concentrated and caustic solutions may in itself prolong the inflammation and prevent the recovery. So that it is always desirable, in a case which has been energetically treated, to interrupt, for two or three weeks, all local applications, in order to allow the irritation caused by them to subside.

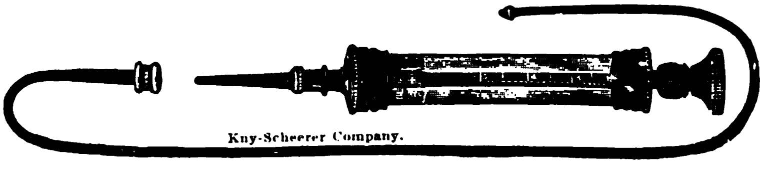

Fig. 91.—Guyon's syringe.

In beginning the treatment with instillations, 15 drops of a 2-grain-to-the-ounce solution of nitrate of silver should be used, which cause some reaction, burning on urination, and increased secretion, which lasts for twenty-four hours and then subsides.

In every case where the presence of posterior urethritis is suspected, the point of the syringe should be carried beyond the cut-off muscle and a few drops of the solution deposited along the posterior urethra; and as the syringe is withdrawn the anterior urethra is "etched," a drop at a time, along its entire length.

The instillations should be made every two days and used two, three, or four times, or, in fact as long as a diminution in the shreds is noted. By this time the urethra has become accustomed to the irritation of the solution, and its strength must be increased to 5 grains to the ounce. The strength of the solutions is gradually increased in this way until the patient is well or until a strength of 25 grains to the ounce is attained.

Various other means have been suggested for applying astringents to diseased spots in the mucous membrane, such as gelatin or cocoa-butter suppositories, medicated ointments, and direct applications through the urethroscope.

None of these methods has proved satisfactory, and, while applications through the urethroscope to the posterior urethra are indispensable in certain cases of swelling of the colliculus, the only use for the urethroscope in the anterior urethra is as an instrument for diagnosis or to permit the removal of polypi or the destruction of chronically inflamed Morgagni's crypts.

The use of *astringent injections* may be continued by the patient himself during this time as an adjuvant to irrigations and stronger applications.

Care should always be taken, however, not to use the injections often enough to add to the irritation resulting from the other applications.

In treating patients with chronic urethritis it should always be borne in mind that in nearly every case a submucous infiltration of small round cells is present in the deeper tissues, often complicated by disease of the paraurethral glands, and it is impossible to cure the lesions on the surface as long as the deep or submucous infiltrate exists.

**The deep form** of chronic urethritis must be treated on entirely different lines from the superficial variety.

In these cases the infiltration lying underneath the mucous membrane can not be reached by applying astringent or bactericidal solutions to its surface, and, while the secretion may be held temporarily in check, an exacerbation occurs on the slightest provocation.

The indications for treatment are:

I. To promote the absorption of the infiltration and restore the elasticity of the urethral wall.

II. To subdue the existing superficial inflammation in the mucous membrane and glands.

III. To destroy the gonococci, which are harbored in the substance of the infiltration and in the urethral glands.

The first indication—that is, the promotion of the absorption of the infiltration—is met by the passage of a **steel sound** large enough to distend the urethra fully and put the ring of infiltration upon the stretch.

The therapeutic effects of the passage of sounds are:

I. To allay urethral hyperesthesia. The passage of the sound blunts the extreme sensitiveness of the nerve filaments and abolishes any spasmodic contractions of the muscular fibers which may be present.

II. The infiltration lying beneath the mucous membrane renders it rigid and impairs its elasticity. A sound large enough to distend the urethra stretches the infiltration and causes small tears in its substance beneath the mucous membrane. A traumatic inflammation, with increased vascularization, results from these tears, and absorption is stimulated.

III. The passage of a sound expresses and squeezes out the contents of the suppurating urethral crypts and follicles.

IV. The stretching of the urethral walls by the sound breaks down granulations and stimulates the formation of epithelium upon eroded spots.

In order to meet these conditions it is necessary to use a sound of *large* caliber, which will fully distend and stretch the urethral canal.

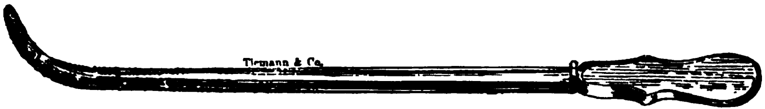

Fig. 92.—Steel sound with Van Buren curve.

The therapeutic effects of the sound can be materially increased by massaging the urethra over it with the fingers. The contents of Morgagni's crypts can in this way be expressed, and a favorable influence is exerted upon the ring of infiltration in the submucous tissues.

The sound should not be passed too frequently. In cases of soft and recent infiltration the intervals may be from two to four days, always waiting until the reaction following has subsided. In cases of hard, organized infiltration the intervals should be longer: from five to eight days.

If the *meatus* is too narrow to admit a sound of sufficient size, it should be divided upon the floor.

There are, however, certain cases where it is undesirable to enlarge the meatus, as, for instance, in hypospadias, and, again, there are other cases where the urethra is so capacious that a No. 30 French sound will lie in it loosely without stretching the walls or compressing the infiltration. In these cases recourse may be had to the **Oberlaender or Kollmann dilator** and by preference the new model of irrigating dilator by which irrigation of the urethra is carried on simultaneously with the dilatation.

The action of a dilator is to tear apart the infiltration underneath the mucous membrane, which remains intact without being wounded.

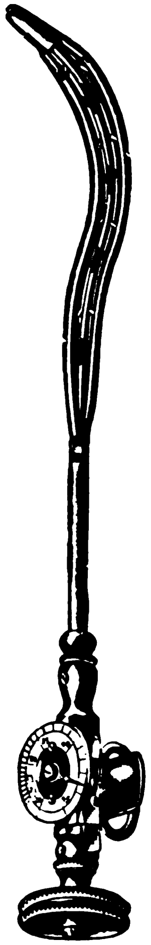

Fig. 93.– Kollmann's anteroposterior dilator.

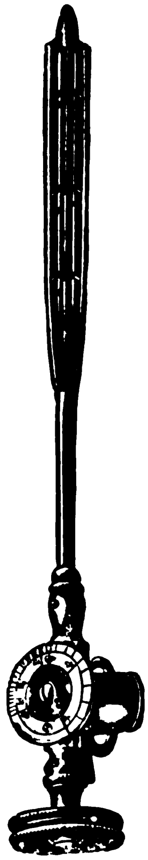

Fig. 94.–Kollmann's dilator for the anterior urethra.

This is an important feature of dilatation, since any fresh wound of the mucous membrane would open up a passage for revived infection with microorganisms.

Oberlaender claims that a fresh inflammation starts up from the tears in the infiltration, and the increased vascularization occurs in its absorption.

The dilatation also causes an exfoliation of epithelium in other parts of the urethra.

The effect of dilatation is also very marked on the mouths of Morgagni's crypts. The mouths of the crypts may be kept open and gaping by a stiffened ring of periglandular infiltration.

Free dilatation puts them on the stretch, forces out their stagnating contents, and causes the absorption of the infiltration. If, on the other hand, the mouths of the crypts are closed by a hyperplasia of epithelium over them, dilatation opens them and permits the escape of the retained secretion.

The Frank or Kollmann dilators with the irrigating attachment are to be preferred to Kollmann's simple dilator, as these instruments are provided with three and four blades, and the pressure is brought on several sides of the urethral wall, lessening the danger of laceration.

It is also of great advantage to irrigate the urethra when it is fully dilated, for at this time the mouths of Morgagni's crypts are open and the irrigating fluid enters them, besides coming in thorough contact with the walls of the urethra, when its folds are smoothed out.

It should always be borne in mind in using these dilators that the dilatation must be made very gently, for with the powerful leverage of the instrument extensive lacerations may easily occur unless great care is used.

A laceration is a serious accident. The hemorrhage may be alarming in its extent and urinary fever is very apt to follow.

If inflammation and secretion are present in chronic gonorrhea, dilatation may be begun at 26 or 28 at the first sitting, and increased at the other sittings.

In a week another dilatation may be made and the dilatations in the course of some weeks carried up to 35 or 36, increasing one or two numbers at each sitting. After 36 is reached the dilatation must be done more cautiously, ascending from one-half to one number at a sitting.

Improvement is generally noted about 35, when the shreds begin to grow lighter.

The dilatation may be carried up to 45, but it is seldom necessary.

When the infiltration is confined to the anterior urethra alone, the anterior dilator is of course required; but when the disease has affected the membranous and prostatic portions of the urethra the posterior dilator must be used.

The dilator may be used even though a few gonococci are present, but it is always better to rid the urethra of gonococci as much as possible by an active course of treatment before commencing the treatment with the dilator.

If the urethra is acutely inflamed and secreting pus freely, instrumentation is, of course, out of the question, and the dilatations should not be begun until the urine is clear and contains only shreds.

With regard to the appropriate solutions for irrigating the urethra, albargin, 1:1000, should be used as long as gonococci are present. After they have disappeared, nitrate of silver, 1:10,000 to 1:4000, is in order. Oxycyanide of mercury, 1:4000, is the best solution when no gonococci, but other microorganisms, are present in numbers.

In the intervals between the dilating irrigations the patient should have urethral irrigations made every other day by the surgeon (see Janet Irrigation), and should use a hand injection of one of the astringent salts himself.

It makes no difference, as far as treatment is concerned, whether the submucoid round-celled infiltration is soft and recent or whether it has been transformed into scar tissue. The indications in either case are, by dilatation and pressure, to promote its absorption. Cases in which a considerable surface of mucous membrane is involved are unsuitable for dilatation, until the catarrh has been checked by irrigations and the superficial process is localized in a few spots in the urethra, as denoted by shreds floating in clear urine.

The second and third indications—which are to cure the inflammation in the mucous membrane and glands and destroy the gonococci—have already been considered under the treatment of the superficial form of urethritis, and the measures adapted to these ends should be combined with the dilatation.

If a steel sound or simple dilator without the irrigating attachment is used, it is always necessary to use a copious irrigation of the urethra afterward.

The folds of the mucous membrane are smoothed out by the pressure of the sound, and the solution comes in contact with the whole surface. If small tears have occurred in the mucous membrane from stretching, the irrigating fluid seals them up and prevents infection.

## GLANDULAR URETHRITIS

Many intractable cases of gonorrhea lasting for years in spite of constant treatment are caused by a chronic inflammation of **Morgagni's crypts.**

Such cases show but few symptoms, merely a morning drop or moisture at the meatus, but are characterized by exacerbations of the discharge after slight provocation, with a free flow of pus containing gonococci, and leading the patient to believe that he has acquired a fresh infection.

Urethroscopic examination shows the mouths of a few of the crypts to be open and pouting, with the edges red and slightly elevated above the surface. In other cases the mouths of the crypts are occluded by a growth of epithelial cells.

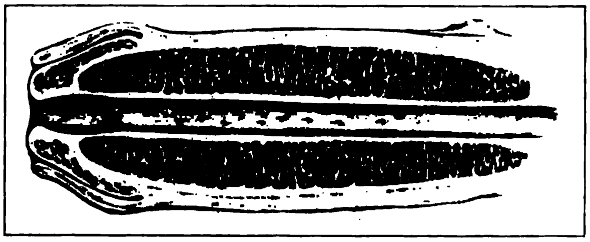

Fig. 95.—Roof of urethra, showing openings of Morgagni's crypts and lacuna magna.

When the crypts are affected the gonococci remain in them for years and retain their infectious properties.

The treatment of these cases may be begun by dilatations with the Kollmann irrigating dilator.

When the mouths of the glands are occluded by the growth of epithelial cells over them, dilatation of the urethra opens up their mouths and forces out the purulent secretion contained within them.

The accompanying irrigation enters their cavities and acts upon the chronic inflammatory process within the glands.

In the second form of affection of the glands, where their mouths are held open and the entire crypt is stiffened and inelastic from the periglandular infiltration, dilatations cause the absorption of the infiltrate around the glands and a return to the normal conditions.

When after sufficient treatment with dilatation and irrigations, it is found by urethroscopic examinations that a few glands still remain chronically inflamed and suppurating, acting as foci of infection, they should be treated as any other suppurating sinus and destroyed. This can be accomplished by bringing them into view with the urethroscope, introducing a galvanocaustic needle into them, and destroying them by the cautery. The cauterization must be very superficial and rapid; otherwise, there is danger of stricture formation.

To avoid the danger of stricture from too much burning, Levin uses an electrolysis needle, which is superficial in its action, but effective.

Three or four crypts may be destroyed at a sitting, and it is possible sometimes, by disposing of the glands harboring the gonococci, to cure a chronic gonorrhea of years' standing which had resisted all the usual forms of treatment.

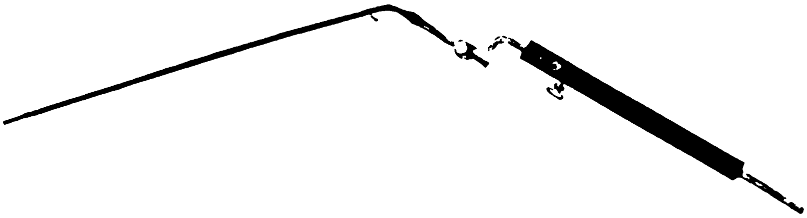

Fig. 96—Galvanocaustic needle and handle.

In all cases of chronic urethritis the condition of the prostate and seminal vesicles should always receive attention, for in the large proportion of individuals so affected the *prostate* and *seminal vesicles* will be found diseased and will require appropriate treatment. (See Prostate and Seminal Vesicles.)

## CHRONIC POSTERIOR URETHRITIS

The posterior urethra is involved in about 80 per cent of all cases of acute gonorrhea. In many of these the disease never becomes chronic, but, when it does, the posterior urethra remains inflamed quite as often as the anterior.

Chronic posterior urethritis may exist alone, the inflammation having run its course and ended in the anterior part of the canal, but we frequently find a chronic inflammation of both anterior and posterior portions of the urethra at the same time.

Acute posterior urethritis is almost invariably caused by gonorrhea, but a *chronic* inflammation can be occasioned in other ways. Any cause which tends to produce a prolonged state of *congestion* in the posterior urethra which is oft repeated will, in time, lead to the establishment of a condition of *inflammation* in the mucous membrane and hyperplasia of the submucous tissues.

The causes which are usually responsible for these conditions are excessive sexual intercourse or sexual abuses, such as masturbation or coitus reservatus (withdrawal).

The habit of withdrawing the penis during the act of coitus and allowing the seminal fluid to be ejaculated outside the vagina, for the purpose of preventing conception, has a most pernicious effect upon the mucous membrane of the posterior urethra. It induces a chronic congestion with involvement of the colliculus, and is always followed sooner or later by an attendant train of nervous symptoms, which are known under the general term of *sexual neurasthenia.*

The habit of masturbation acts in precisely the same way, and the men who practice it present the same group of symptoms.

Another cause which occasionally operates in inducing chronic posterior urethritis is horseback riding upon a saddle which is improperly made so that the middle ridge presses upon the posterior urethra. The prolonged intermittent pressure upon the colliculus sets up at first a congestion and finally a true colliculitis.

For all practical purposes, the symptoms and treatment of chronic posterior urethritis may be considered together, without regard to its etiology.

## Pathology

On account of the abundant supply of glands and follicles and the thickness and vascularity of the mucous membrane the pus formation is apt to linger in the posterior urethra for years, and is very apt to attack the prostate and seminal vesicles.

The histologic changes are substantially the same as in chronic anterior urethritis.

The mucous membrane is in a state of chronic inflammation, with desquamation of its epithelium, and the submucous tissues are the seat of a small round-celled infiltration, which also surrounds the mucous crypts. The infiltration, in time, becomes converted into scar tissue and the glands are obliterated by its pressure. The infiltration, however, is not transformed into distinct *bands* of scar tissue, such as form strictures in the anterior urethra, but there is simply a *general condensation* or *fibrous hardening* of the periurethral tissues.

The sclerosis of the submucous tissue does not materially narrow the caliber of the urethra, and, consequently, stricture never occurs in the posterior urethra, except from traumatic origin.

The *verumontanum*, or *colliculus seminalis,* is always affected in chronic posterior urethritis. It is enlarged, the mucous membrane is bluish in color and softened, and the natural sensitiveness is aggravated to a high degree. This structure is the point most highly supplied with nervous filaments in the urethra, and, on account of its increased receptive influence to painful impressions, when the submucous infiltration begins to contract it compresses these nerves and occasions marked reflex disturbances.

The symptoms are often *mental*, and take the form of hypochondria, depression, irritability, and inability for sustained mental effort, or may be *neuralgic* in character and referred to distant or associated organs.

## Diagnosis

The two-glass urine test is only applicable to cases where there is a considerable amount of pus formation, in which both first and second glasses are turbid and often contain small shreds shaped like a comma or tadpole.

These are known as *Fürbringer's hooks* and are plugs of secretion which have been formed within the mouths of the prostatic ducts.

When present they denote that the general inflammation of the posterior urethra has extended by continuing into the prostatic ducts.

In the following instances the posterior urethra may be chronically inflamed and the second glass of urine will not be discolored:

(*a*) When such a *small quantity* of pus is secreted that it does not flow back and discolor the urine in the bladder.

(*b*) When the stream of urine is feeble in force and not sufficient to wash out the mucous plugs from the crypts and follicles in the mucous membrane and the mouths of the prostatic ducts, contraction of the muscular structures surrounding the urethra is necessary to accomplish their emptying.

(*c*) The prostate gland and seminal vesicles may be chronically inflamed and yet the pus formed does not flow out freely enough to appear in the urine *unless* direct pressure is made upon those organs by means of the finger in the rectum.

The **Jadassohn-Van Zeissl method** is useful in overcoming objections *a* and *b*. The *technic* is as follows:

The *anterior* urethra is irrigated by means of a catheter attached to a syringe or irrigator, which is carried down to the cut-off muscle. After the anterior urethra has been thoroughly cleansed the patient urinates in a glass, and the urine contains the pus or shreds washed out from the posterior urethra. The patient then passes the remainder of his urine in another glass, which represents the condition of the urine which had accumulated in the bladder.

After both anterior and posterior urethras have been cleansed of accumulated secretions by washing out and urinating, the secretions from the prostate gland and seminal vesicles should be collected by means of **Jadassohn's expression urine test.** By means of a finger in the rectum pressure or massage is exerted upon the prostate gland and the seminal vesicles, and their contents are squeezed out into the urethra. The patient then urinates and washes out the expressed secretions into a glass. The urine in the glass containing the secretions expressed from the prostate and vesicles is called the *expression urine.*

In examining cases of chronic posterior urethritis we should always pay particular attention to the condition of the *seminal vesicles* and *prostate gland.* These organs are very liable to be affected by an extension of the gonorrheal inflammation from the urethra, and when once attacked the gonococci are very likely to remain in them and continue to propagate for months and, indeed, in some cases, for years.

The **urethroscope** is always indispensable in making the diagnosis of chronic posterior urethritis, but should not be used until the disease has become very chronic.

If introduced prematurely into the posterior urethra it causes extreme pain and may aggravate the inflammation.

There is also some danger of its inducing epididymitis or vesiculitis. Without a urethroscopic examination, however, it is impossible to diagnose or successfully treat this condition, and in the chronic nongonorrheal cases with but little secretion its use in practised hands is free from danger.

After introducing the urethroscope in a case of chronic posterior urethritis the urethra is seen to be of a purplish color and bleeds so freely that the view is obscured until the blood is wiped away with cotton tampons.

The colliculus is swollen and enlarged, appearing like a half-ball and filling up the end of the tube and of a bright red or bluish color.

After the stage of formation of connective tissue beneath the mucous membrane, the appearance of the colliculus is altered, and, instead of being swollen and red, it is flat, irregular, and grayish white or yellow in color.

In very chronic cases small polypi are frequently seen growing from the colliculus.

## Symptoms

If the posterior urethra alone is diseased, there is an *absence* of purulent discharge from the meatus.

In the later stages of the disease there is but very slight pus formation, simply a congestion of the mucous membrane, with an infiltration and condensation of the submucous tissues. But in the early stages and in exacerbations, the pus formation may be in considerable quantity, and will be easily shown by making the two-glass urine test.

On account of the chronic inflammation, the posterior urethra is always in a state of exaggerated sensitiveness, and the necessity for **frequent urination** is nearly always present. Usually the desire to urinate is so *urgent* that the patient can not wait, but must respond at once to the call, or the urine escapes and wets his clothing.

**Sexual symptoms** are nearly always prominent. The sexual appetite is disturbed. There is either no inclination for coitus and, if indulged in, a condition of general nervous depression follows, or else there may be a constant desire for sexual intercourse, which is not satisfied by indulgence.

The act of coitus is not satisfactorily performed. Ejaculation occurs prematurely on account of the irritable condition of the posterior urethra, and for the same reason *seminal emissions*, or pollutions, occur at night during sleep, more frequently than is natural, and in some cases the seminal discharges may be stained with blood, which is derived either from the congested posterior urethra or else from an inflamed condition of the interior of the seminal vesicles.

If the case is allowed to go on without treatment the symptoms of feeble erection and premature ejaculation give place to a condition of absolute lack of erection and impotence in the final state.

It is not at all improbable that many of the brutal attacks and attempts at rape upon women and female children may be due to the prolonged irritation in the posterior urethra from a chronic inflammation, causing an erotic mental state which the aggressor finally finds himself unable to control. The same may be true of persons who are guilty of the various forms of sexual perversions, and it is possible that by suitable local treatment of the posterior urethra these individuals might be returned to the ways of ordinary decent life.

**Mental symptoms** are a striking feature of most cases of posterior urethritis. The patients are hypochondriac, they suffer from depression of mind, and are low-spirited, melancholy, and despondent, and in extreme cases may have suicidal impulses. In this frame of mind they fall an easy prey to quacks and charlatans, whose advertisements guaranteeing to "restore lost manhood and relieve the evils attendant upon the errors of youth" appear in the columns of the daily papers.

**Nervous symptoms** are always prominent, and the patient complains of a heavy feeling or a constant burning or tickling in the perineum or region of the bladder. Sometimes a feeling of heat is observed in the posterior urethra, which is increased by urination, and ejaculation is often accompanied by a shooting pain. In consequence of the irritability of the posterior urethra a spasmodic contraction of the cut-off muscle is often present, and the urine is passed in a thin, dribbling stream, as though the urethra were occluded by an organic stricture.

The reflex pains are vague and irregular in character, often shooting toward the glans penis, testicles, or down the thighs, and are increased by any bodily movement, such as riding or walking

Usually such patients can not sit in a cushioned chair on account of the pressure upon the perineum.

The patient is easily tired and incapable of his usual amoun of mental or physical work, and presents the clinical picture of mild form of neurasthenia. The symptoms thus grouped togethe are commonly spoken of as **sexual neurasthenia** and disappea

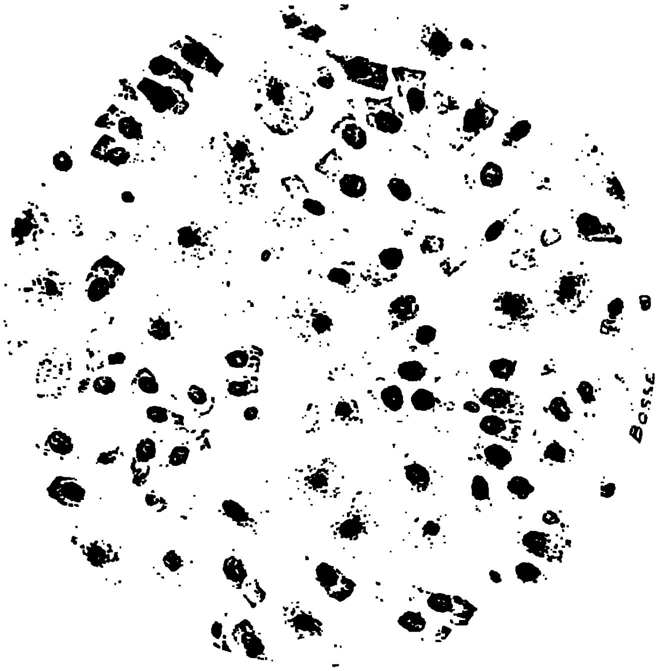

Fig. 67. Secretion of prostatorrhea. Catarrh of prostatic ducts, containing only epithelium, cylindrical and squamous. Original drawing from microscopic specimen.

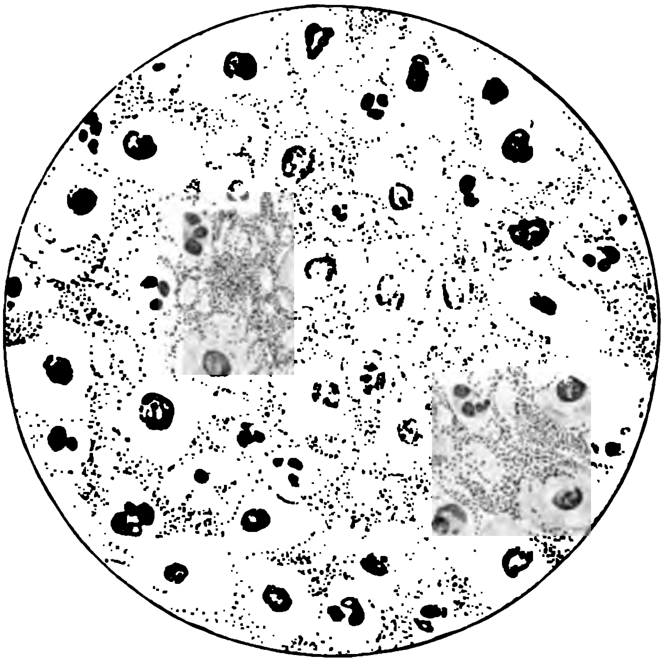

Fig. [illegible] Secretion of prostatorrhea. Large numbers of bacteria, epithelial cells, and a few pus cells. Original drawing from microscopic specimen.

promptly as soon as the local conditions upon which they depend are cured, and it is really remarkable to see the rapid improvement or disappearance of all the unpleasant feelings as soon as appropriate treatment is begun.

**Prostatorrhea** is often complained of, especially in the cases caused by masturbation or withdrawal. The flow of a glairy mucus may come with the last drops of urine voided (micturition prostatorrhea), or it may result from straining at stool (defecation prostatorrhea). The change in the tissues of the posterior urethra consists in a submucous infiltration surrounding the prostatic ducts and keeping them open and rigid, together with a proliferation of the epithelium within the ducts. Sometimes the proliferation of the epithelium closes the mouths of the ducts, and they become converted into small cyst-like cavities.

If the discharge is collected upon a glass slide and examined with the microscope, two distinct varieties of the process are observed: (*a*) The discharge consists of epithelial cells from the prostatic ducts, and is caused by a pure desquamative catarrh of the acini, without suppuration. (*b*) In addition to the epithelial cells numbers of polynuclear leucocytes are found, denoting a purulent inflammation of the ducts.

**Spermatorrhea** is occasionally present, but not so frequent as prostatorrhea. It has been shown by Finger to be caused by a stiffening and rigidity of the ejaculatory duct from a surrounding infiltration, which causes its dilatation and closes imperfectly the outlet to the seminal vesicles, so that slight muscular pressure forces the semen to leak out.

Finger also describes a more unusual form, in which diverticula exist in the ejaculatory duct. During coitus or pollutions the semen is forced into the diverticula, where it lies until expelled by the muscular contraction during urination or defecation.

The **differential diagnosis** between prostatorrhea and spermatorrhea can only be made by collecting the discharge on a glass slide and examining it with the microscope.

**Prostatorrhea** is found to contain epithelial cells and lecithin bodies; pus may be present or not. Occasionally large quantities of granular phosphates are visible, and sometimes amyloid bodies can be seen.

On mixing the material with a 1 per cent watery solution of phosphate of ammonium and letting it dry, **Böttcher's crystals** are often found. These are rhomboid in shape, and are formed by a chemical combination of the phosphate of ammonia and some material which is peculiar to the prostate and does not exist anywhere else.

The appearance of the fluid discharged in **spermatorrhea** is entirely different. It is composed of varying-sized globular masses of mucus, small quantities of granular phosphates, and numerous spermatozoa.

The presence of pus denotes a diseased condition of the seminal vesicles.

### Treatment

In chronic inflammation of the posterior urethra resulting from sexual excesses or abuses, the anterior urethra is not involved, and the treatment is directed to the posterior urethra alone, but in the cases caused by gonorrhea both anterior and posterior urethra are usually equally affected, and the treatment must include both parts of the canal.

For purposes of treatment it is well to divide the cases of posterior urethritis into three groups:

(*a*) **Superficial,** in which the mucous membrane and mouths of the prostatic ducts are involved in the inflammatory process.

(*b*) **Deep form,** in which, in addition to the inflammation in the mucous membrane, there is an *infiltration* in the deeper tissues.

The small round-celled infiltration is deposited here and ultimately is converted into scar tissue. It does not contract and form fibrous bands, but merely produces a general condensation and hardening of the submucous tissue.

(*c*) **Colliculitis, or Inflammation of the Verumontanum.**—In this condition the colliculus seminalis is the part chiefly affected, as shown by its hyperemic swelling and congestion.

In the superficial form of chronic posterior urethritis, in which the mucous membrane and prostatic acini alone are involved, where there is a considerable amount of pus formation, **irrigation** by means of an irrigator or syringe and soft-rubber catheter introduced beyond the cut-off muscle, using albargin 1:1000, nitrate of silver 1:4000, or permanganate of potash or ichthargan solutions, will generally check the secretion. After the suppuration has lessened, **instillations** *with Ultzmann's syringe,* carried behind the cut-off muscle into the posterior urethra, of 15 drops of a nitrate-of-silver solution, beginning with 2 grains to the ounce and increasing as directed in the treatment of "Chronic Anterior Urethritis," usually causes a prompt disappearance of the remaining secretion and shreds. If it is desirable to medicate the posterior urethra without having the nitrate-of-silver solution come in contact with the interior of the bladder, it is well to make the instillation with the bladder full of urine. In that event any of the solution which flows back into the bladder is neutralized by the salts of the urine.

If, on the other hand, we wish to affect the base of the bladder as well as the posterior urethra, the bladder should be emptied of urine before making an instillation.

In nearly every case of posterior urethritis which becomes chronic after an acute gonorrhea, the prostate is found to be the seat of a chronic gonorrheal prostatitis; the seminal vesicles are also often affected, and it is impossible to cure the gonorrhea by treating the urethra alone; the prostate and vesicles must also receive attention at the same time. (See chapter on Prostatitis.)

Under the use of irrigations, instillations, and massage of the prostate, the inflammation in the mucous membrane is generally healed, and the *submucoid infiltration*, if present, should receive appropriate treatment.

To accomplish the absorption of the infiltration it is necessary to use **dilatations of the posterior urethra** by means of sounds or dilators. Forcible dilatation or tearing apart of the tissues is harmful, and we should proceed with the utmost gentleness and caution in the manipulation of sounds in this region. The sound, of course, should never be passed until the free suppuration has ceased and there are only very chronic and indolent inflammatory residua remaining, on account of the danger of increasing the inflammation or of causing epididymitis.

The **Guyon sound** is particularly adapted to the posterior urethra, on account of its shape, which is similar to that which a soft catheter assumes when it lies in the bladder and urethra. The weight of the Béniqué sound has some advantage, as it produces a certain amount of compression and so stimulates absorption of the infiltration, besides emptying out the crypts and follicles.

A better instrument to use, however, is the **Kollmann-Frank irrigating dilator for the posterior urethra.**

It should not be used if gonococci are present, and great care should be taken not to dilate too rapidly and so lacerate the tissues or excite epididymitis, as the tolerance to instrumentation is far less in the posterior urethra than in the anterior. During the dilatation the irrigation of the urethra should proceed with a solution of nitrate of silver, 1:4000. The advantage of the irrigating dilator over the simple is that at the time of full dilatation the urethral folds are smoothed out and the prostatic ducts are distended, so that the solution comes in contact with their open mouths.

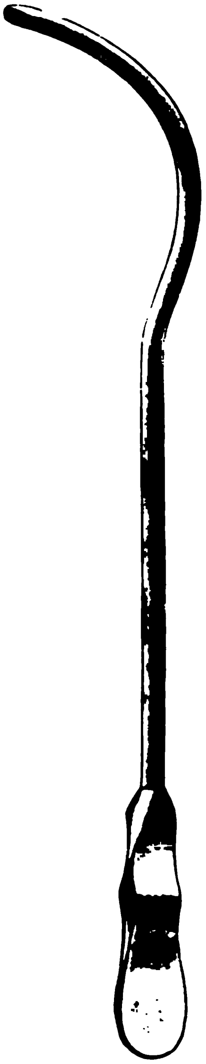

Fig. 99.—The Guyon sound.

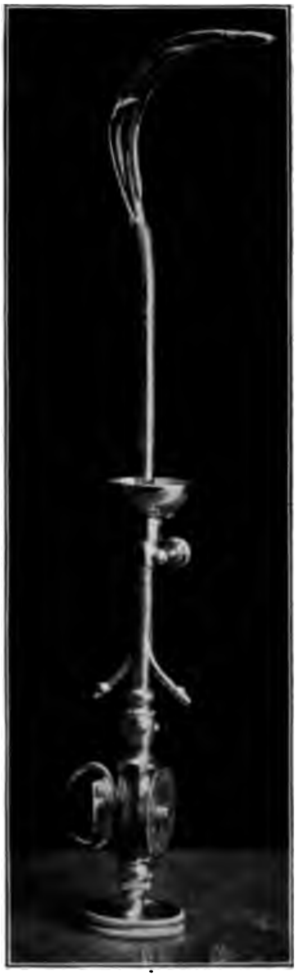

Fig. 100.—Frank's posterior dilator.

In every case of chronic posterior urethritis the condition of the seminal vesicles should be investigated by rectal examination. It is useless to attempt to cure an inflamed posterior urethra when a pair of inflamed seminal vesicles are discharging a quantity of gonorrheal pus into the urethra every few days and causing an *exacerbation.* Many cases of relapsing posterior urethritis will get permanently well through a systematic stripping of the seminal vesicles, when everything else has been tried in vain.

At the same time the prostate should not be overlooked, for a follicular prostatitis is often present as a complication, and should be treated by massage through the rectum, in order to empty out the contents of the inflamed and dilated prostatic ducts.

In the very chronic cases of posterior urethritis of long standing and due to sexual excesses, masturbation, or withdrawal, the measures described above are usually not sufficient to effect a cure, although a certain amount of relief is obtained.

These cases usually come under the heading of the third class, or **colliculitis.**

There is but little or no pus formation, perhaps not even comma shreds, in the urine; submucoid infiltration may be absent, and, although the patient may present a typical clinical picture, the diagnosis can not be made without examining the posterior urethra with the **urethroscope.**

On introducing the endoscope the posterior urethra is found to be swollen, congested, of a deep red or purple color, and bleeding freely, and the colliculus appears filling up the end of the tube like a half-ball, bright red or dusky in color, and exquisitely sensitive.

It is generally advisable to begin treatment by a few irrigations or instillations, and, after a fortnight's preliminary treatment, applications should be made through the urethroscope directly upon the colliculus, and care should be taken not to allow the excess of fluid to flow over the surface of the posterior urethra.

In cases where only a moderate swelling and hyperemia exist the colliculus should be painted with tincture of iodine,[1] but in the severe cases with marked enlargement the colliculus must be cauterized with nitrate-of-silver solution, 50 to 100 grains to the ounce. In very obstinate cases which do not respond to the above measures, it is necessary to burn the colliculus with the galvanocaustic point. Polypi may be twisted off with the urethral forceps or destroyed with the galvanocaustic point. After the cauterization the patient should keep quiet for two to three days, and urotropin is administered to prevent urethral fever.

The applications of nitrate of silver or cauterization should not be made oftener than once in ten to fourteen days.

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[1] Wossidlo: Die Erkrankung des Colliculus Seminalis, Ztschr. f. Urol., 1908, ii, No. 3.

In most patients so treated the reflex nervous and mental symptoms disappear, irritable impotence ceases, prostatorrhea and spermatorrhea no longer occur.

After a state of complete impotence is established, cauterization of the colliculus is less apt to be followed by a return of the sexual power, but even these cases sometimes respond.

In all the forms of chronic posterior urethritis under the treatment described in the preceding pages the symptom-complex known as **sexual neurasthenia** rapidly clears up and generally disappears entirely, but some traces occasionally remain, even after the local changes in the posterior urethra and its adnexa have been cured.

This implies that some alteration in the functional capacity of the nerves still remains, which demands treatment with **faradic electricity**.

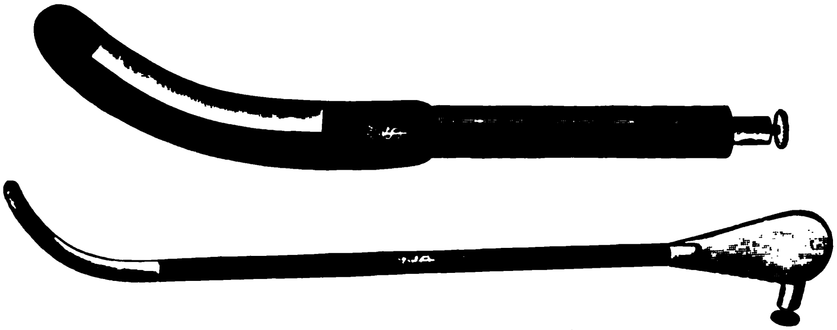

Fig. 101.—Rectal and urethral electrodes.

The galvanic current should not be used, for it causes electrolysis and acts as a caustic. Frank advises the faradic current with one pole in the rectum and the other in the urethra.

The *high note* is to be preferred, as it relaxes spasm and also has a sedative action on the nerve and obtunds its sensation.

The low note stimulates flabby muscles to powerful contraction and results in increased nutrition and better tone, but the spasm is increased. (Wappler.)

In the presence of profound neurasthenia which does not clear up under local treatment, the patient should be sent to an institution under the care of a competent neurologist, where the condition can be correctly treated by baths, regulated exercise, diet, and mental suggestion. It is impossible to handle these neurasthenics in their homes and a cure can only be brought about by a regulated course of hygiene and general care as carried out in an institution well equipped and devoted to that purpose.

## Résumé of the Diagnosis, Prognosis, and Treatment of Chronic Urethritis

In examining a case of chronic urethritis, it is desirable to proceed in a systematic way, so that important points may not be overlooked, and the author finds the following scheme a satisfactory one in practice:

The **patient's history** is first obtained, and the number, duration, and attendant complications of previous attacks of gonorrhea are noted.

The surgeon next inquires about the *present attack*, ascertaining how long it has lasted, what treatment has been used, the amount of discharge, and whether frequent and urgent urination is present. The patient is asked about his *mental symptoms,* whether he is despondent, irritable, and depressed.

The *sexual symptoms* are inquired into, and the patient is asked if, on coitus, the ejaculation is premature and if the erections are firm; also if seminal emissions occur and how frequently, and if by night alone or in the day as well. (Prostatorrhea, spermatorrhea.)

The **physical examination** is then begun, and the *testicles* are examined for varicocele, epididymitis, or orchitis. The *meatus* is inspected, to see if it is too small or if hypospadias is present.

**Smears** of the pus discharging from the urethra are made on two cover-glasses.

The patient is then requested to pass a small quantity of urine in a glass.

The contents of **glass 1** are observed, to note if the urine is turbid or clear and contains clap-shreds. If the urine is turbid from *phosphates,* the addition of a few drops of nitric acid will cause it to clear up.

If the urine, however, is turbid from *pus,* it is an important contraindication to any urethral instrumentation, and the patient is put on irrigations until the pus disappears and the urine is clear, with shreds floating in it. When this result is attained it is proper to begin instrumentation of the urethra, and not before.

If the bladder contains a sufficient quantity of urine upon the first visit, the two-glass urine test may be made, and the contents of **glass 2** noted. The presence of pus in the second glass indicates involvement of the posterior urethra, although in certain conditions the Jadassohn-Van Zeissl method must be used to determine this point.

If there is only a small quantity of urine in the bladder, we can omit securing glass 2 and proceed directly to the **examination of the rectum.**

With the patient in the leap-frog position, the *prostate* is examined, to ascertain whether it is enlarged, and, if so, whether it is *hard* or *soft*. The upper border is sought for, to find or exclude perivesiculitis.

The condition of the *seminal vesicles* is ascertained, and the surgeon notes if they are soft and distended, or hard and painful.

The contents of the seminal vesicles and prostate are then expressed and squeezed through the ejaculatory and prostatic ducts into the posterior urethra.

Immediately after the stripping the patient urinates into a glass, thus washing out of the urethra the secretions of the prostate and vesicles which have just been expressed. This mixture of prostatic and vesicle secretion and urine is termed **expression-urine** and is always carefully inspected. If the prostate and vesicles are healthy, the expression-urine is only slightly milky in color, but if these organs are diseased, the expression-urine contains heavy masses, shreds, or free pus, which sinks to the bottom of the glass on standing.

Instead of collecting the expressed prostatic secretion in the urine, it may be caught on a glass slide and, after drying, stained and examined with the microscope.

The author believes that obtaining a knowledge of the condition of the prostate and vesicles is the most important step in the whole examination, for these structures may harbor gonococci for months, and possibly for years.

Disease of these organs is responsible for innumerable cases, where innocent wives have been infected with gonorrhea by their husbands, the causation of impotence, and, in the light of recent pathologic research, may perhaps be the cause of the enlargements of the prostate which occur in old men.

The expression-urine should always be examined microscopically.

If normal, the sediment is found to contain mucus, granular phosphates, and spermatozoa. Sometimes amyloid bodies and phosphatic concretions are present, and Böttcher's crystals appear on adding 1 per cent solution of phosphate of ammonium.

Disease of the prostate and vesicles is denoted by the presence of pus cells. Gonococci may or may not be found; but if much pus is present, the likelihood of the existence of gonococci is very strong.

In doubtful cases attempts have been made to prove the presence or absence of gonococci by making cultures from the prostatic fluid on hydrocele agar. It is very difficult to grow the gonococcus, and they may exist in the prostate without appearing upon the culture plates.

Provocative instillations of nitrate of silver, gr. v to the ounce, into the posterior urethra, followed in twenty-four hours by massage of the prostate and microscopic examination of the expressed secretion, is much more liable to disclose the gonococci if still present than attempts at cultivation.

The next step in the examination consists in **exploring the urethra,** provided the urine is clear and contains only floating shreds.

The *urethrometer* may be used for two purposes, but the author prefers a flexible *bulbous bougie,* with which a hard or soft infiltration can be easily recognized.

The findings of the bulbous bougie may be confirmed and additional light thrown on the case by the **urethroscopic examination.**

The most important pathological feature of chronic urethritis is the *infiltration,* for the erosions and glandular changes depend upon it. With the urethroscope we are able to determine whether the infiltration is hard or soft, and we can also observe the presence of erosions, glandular changes, and granulations.

The posterior urethra is more difficult and more painful to examine than the anterior. The chief points of interest are the verumontanum and the color of the mucous membrane, which in diseased conditions is purple and rough and bleeds freely.

After completing the examination of a patient in the manner thus detailed and deciding what parts are affected; if the anterior urethra alone is involved, or if both anterior and posterior urethras are affected, and complicated perhaps by prostatitis or vesiculitis, we are in a position to begin the treatment of the case.

In most cases of chronic urethritis we find that there is a chronic inflammation, with more or less infiltration, affecting both anterior and posterior urethras, and that in addition the prostate is generally involved, and frequently the seminal vesicles as well.

## Method of Examining a Case of Chronic Urethritis

### First Day

History: Take in detail.

I. Inspect pus squeezed from meatus.

II. Examine urethra with bulbous bougie or urethrometer.

### Second Day

III. Wash out shreds and secretion from anterior urethra.

IV. Patient urinates in glass No. 1. No. 1 contains washings from posterior urethra.

V. Examine prostate and seminal vesicles per rectum.

VI. Patient urinates in glass No. 2. No. 2 contains expression-urine from prostate and seminal vesicles.

VII. Examine shreds and pus secreted by urethra, microscopically.

### Third Day

VIII. Examine urethra with endoscope unless a considerable portion of the mucous membrane is inflamed and secreting pus freely.

## Prognosis

The duration of chronic urethritis is always protracted and requires great patience on the part of physician and patient. From the experience of the leading genitourinary specialists in this country and Europe, as developed by the results of the investigations of the committee of the American Medical Association, six months may be accepted as the average duration of the treatment of chronic gonorrhea, while in the experience of some of the reporters about 3 per cent of the cases were incurable by any treatment whatever.[1]

The test as to when the patient is cured is the *permanent absence of pus cells* and *gonococci in the urethral secretions.*

When all discharge has ceased from the anterior urethra, in order to get material for microscopic examination it is necessary to inject a syringeful of 2 per cent nitrate-of-silver solution into the anterior urethra. A free discharge of pus follows, which ceases in twenty-four hours. If no gonococci are found in the resulting secretion after microscopic examination of several smears, it is safe to conclude that the microorganisms have all been eliminated from the urethra in front of the cut-off muscle.

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[1] Morrow: Social Diseases and Marriage, 1904.

The secretions of the prostate and seminal vesicles should be expressed by the finger in the rectum and examined at the same time. It is from these organs that the chief danger of infection comes after discharge has ceased from the meatus, and they are responsible for the majority of cases of infection of wives and mistresses. In examining the expressed secretions from the prostate and vesicles it is not enough to demand absence of gonococci; we should insist upon an *absence* of *pus cells,* for if pus cells are present there may be an occasional gonococcus in a cell which might easily be overlooked.

Provocative instillations into the posturethra of nitrate of silver, gr. v to the ounce, followed by massage of the prostate, are more useful in disclosing the presence of gonococci than cultures, for this organism often refuses to grow, especially in chronic cases.

It is estimated that one-eighth of all the diseases of women are occasioned by gonorrheal infection attacking the vagina or cavity of the uterus, and thence extending to the Fallopian tubes and ovaries. In view of these facts, a patient who has suffered from chronic gonorrhea should only be allowed to marry when examination shows:

I. Absence of gonococci from the anterior urethra.

II. Absence of pus cells from the expressed secretion of prostate and vesicles.

III. Freedom from stricture.

IV. A healthy normal condition of prostate and seminal vesicles.

V. A negative complement-fixation test.

Instead of making the examination on three days as described on the preceding page, the entire procedure can be completed at one sitting if the following order is adopted:

The routine examination to determine if a man is a proper candidate for marriage, as employed by the author, is as follows: The discharge from the meatus has ceased and the urine is clear and free from pus shreds. (Filaments composed of squamous epithelium are innocuous.)

I. Patient urinates, retaining a part of the urine in the bladder.

II. Prostate and vesicles are examined per rectum. Note outlines, consistency, and if perivesiculitis be present.

III. Collect expressed secretion on glass slide as it issues from meatus, or centrifuge expression-urine for sediment.

IV. Make slides, stain, and examine with microscope. Presence of pus cells denotes disease of prostate or vesicles even though no gonococci be found.

V. A negative complement-fixation test.

VI. Examine anterior urethra with bougie à boule to determine presence or absence of stricture, and confirm by examination with urethroscope; also note if Morgagni's crypts are gaping, inflamed, and if pus is issuing from them.

VII. Inject nitrate of silver solution, gr. x to ounce, into anterior urethra, to excite suppuration.

VIII. Make two smears of resulting discharge four to twelve hours after injection, stain, and examine with microscope for gonococci.

Certain cases of chronic urethritis suffer from *excess* of *treatment,* and the inflammation is maintained by the irritation produced by the local applications.

After a case has been under treatment for a couple of months, it is always desirable to stop all injections or instillations for ten days in order to make sure that the natural process of recovery is not retarded by overtreatment.

Entire disappearance of *shreds* is not to be looked for. The erosions have been covered with many layers of squamous epithelium, and continuance of desquamation of the upper layers goes on as the new cells are formed in the depths.

The shreds appear as thin filaments which float in the urine, and microscopic examination shows them to be composed of squamous cells alone without containing any pus corpuscles.

### Treatment

In beginning the treatment of a case of chronic urethritis, the condition of the urine indicates the therapeutic measures to be adopted. If the urine is cloudy and turbid from pus in both glasses, as is generally the case, urethrovesical irrigations should be used until the urine no longer contains pus, but only shreds.

If gonococci are still present, the best drug to use is albargin, 1:1000.

If gonococci are not evident and the discharge is scanty and the urine is clear, with shreds, nitrate of silver, 1:4000, may be used, and if gonococci are present the discharge will be increased at once. If there is a considerable amount of suppuration without gonococci, permanganate of potash, 1:3000, is a suitable remedy.

In the author's experience, a subacute urethritis with a *moderate amount of discharge* from the urethra is usually best treated by albargin, 1:1000, or 1:3000 permanganate irrigations, while a *slight* *discharge* of pus or the presence of *abundant heavy shreds* requires irrigations every second day with nitrate-of-silver solution from 1:10,000 to 1:2000.

After continued irrigations, when the urine has become *clear with shreds* floating in it, it is proper to begin *dilatations,* with the object of causing absorption of the round-celled infiltration. The infiltration exists in greater or less degree in practically every case of chronic urethritis, and must be got rid of, to prevent stricture and allow the superficial lesions to heal.

It is better to begin the dilatation with *sounds,* after cutting the meatus if necessary. When the limit has been reached with a sound, which is from 28 to 32, the treatment should be continued with the *Kollmann dilator.* After each dilatation, the urethra should be irrigated with 1:4000 nitrate-of-silver solution.

Instead of using the sounds, dilatations with the Kollmann irrigating dilator may be begun at once.

While treating the urethra, it is highly important not to overlook the prostate and seminal vesicles, for the prostate is affected in nearly every case of long standing, and very frequently the seminal vesicles as well.

The prostate and vesicles should be massaged regularly, twice a week, to empty the prostatic tubules of inflammatory products and to cause the absorption of the perivesicular infiltrations.

After each massage or stripping, an intravesical irrigation of nitrate-of-silver solution, albargin, or oxycyanide of mercury, or in very chronic cases an instillation into the posterior urethra with an Ultzmann syringe, should be employed.

Massage of the prostate and dilatations of the urethra should not be used on the same day, on account of causing too much irritation.

The surgeon should also remember that treatment of any kind, if continued for too long, causes in itself that which maintains the disease in the urethra. It is always well to stop all treatment for a few days, every two or three months.

The treatment as above outlined, consisting in irrigations and dilatations of the urethra, with massage of the prostate and vesicles, will be all that is required in most cases. When, however, a patient fails to get well, it usually implies that some focus of infection, often in one of Morgagni's crypts, is still present which has been overlooked, that a constitutional diathesis exists, or the treatment has been incorrectly applied.

The patient should clearly understand before beginning treat-

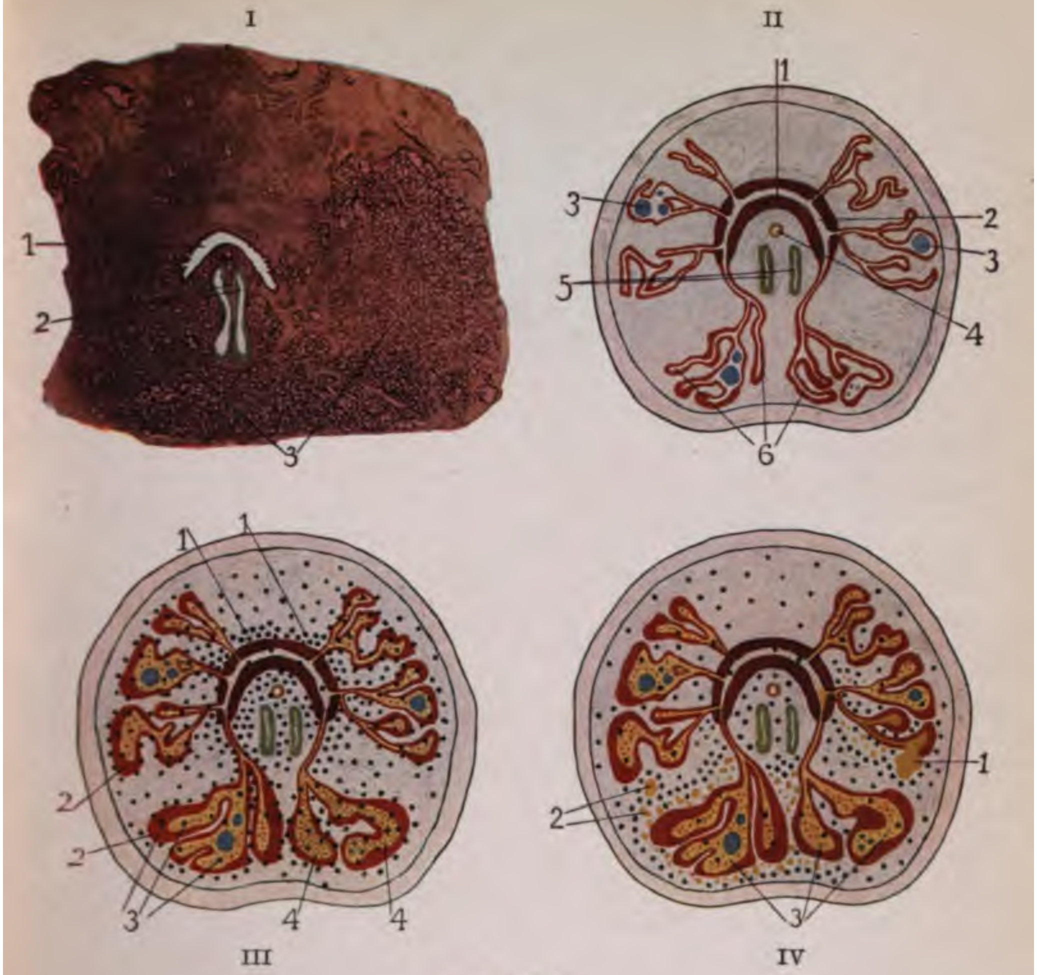

PLATE XXI.

I. SECTION OF A NORMAL PROSTATE.

1. Urethra.
2. Ejaculatory ducts.
3. Prostatic tubules.

II. NORMAL PROSTATE.

1. Verumontanum.
2. Urethra.
3. Corpus amylaceum.
4. Sinus pocularis.
5. Ejaculatory ducts.
6. Prostatic tubules.

III. CATARRHAL PROSTATITIS.

1. Round-celled infiltration of fibro-muscular tissue.
2. Dilated prostatic tubules—walls thickened.
3. Round-celled infiltration of tubules.
4. Exudate with desquamated epithelium.

IV. PARENCHYMATOUS PROSTATITIS.

1. Small abscess rupturing into tubule.
2. Miliary abscesses.
3. Dilated tubules containing exudate (catarrhal inflammation).

NOTE.—On account of the difficulty in demonstrating the pathologic changes occurring [illegible] conditions of the prostate, the above series of diagrams was made, under the [illegible] Harlow Brooks, by Mr. J. Henrici, at the author's suggestion, hoping that [illegible]tation would make the conditions more intelligible to students.

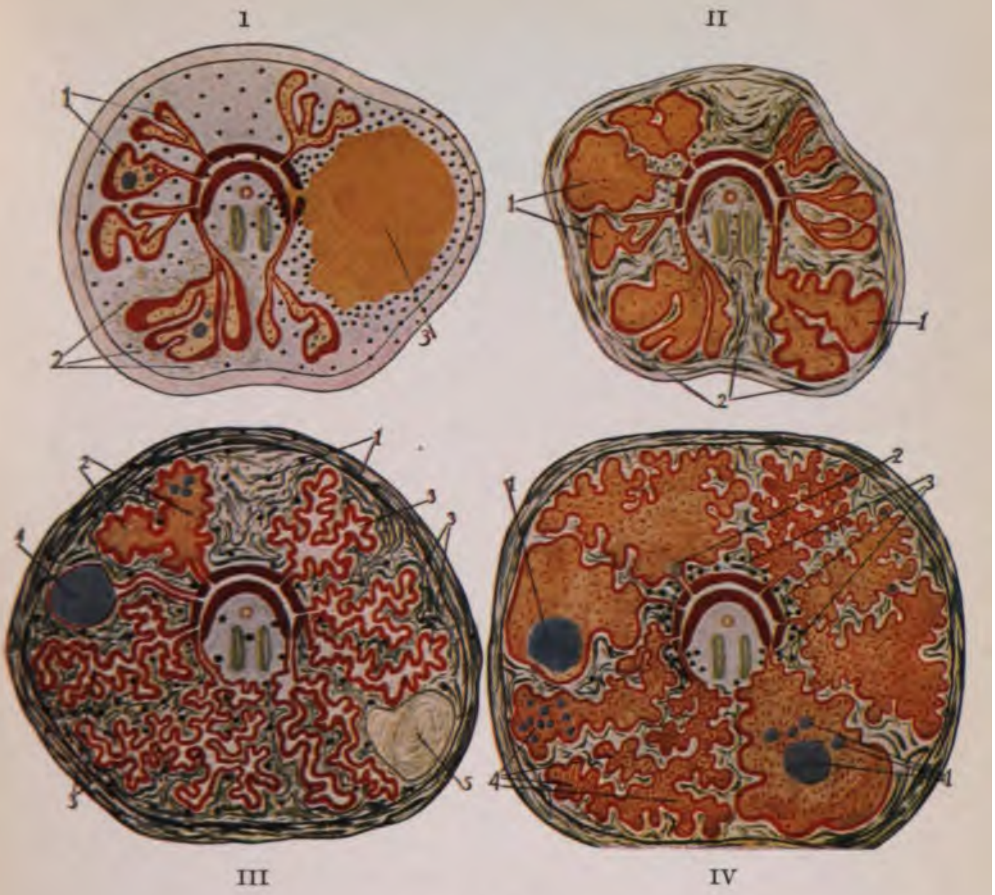

PLATE XXII.

I. SUPPURATION OF LATERAL LOBE OF PROSTATE.

1. Dilated tubules containing exudate (catarrhal inflammation).
2. Interstitial hyperplasia about miliary abscess.
3. Large abscess rupturing into urethra.

II. CHRONIC PROSTATITIS.

1. Dilated tubules filled with exudate, pus, and desquamated epithelium.
2. Hyperplastic connective tissue.

III. HYPERTROPHY OF PROSTATE (FIBROID TYPE).

1. Interstitial hyperplasia.
2. Dilated tubule filled with secretion.
3. Tubules compressed by increase of interstitial tissue.
4. Encysted amyloid body.
5. Fibroma.

IV. HYPERTROPHY OF PROSTATE (ADENOMATOUS TYPE).

1. Amyloid bodies.
2. Duct occluded by amyloid body.
3. Hyperplastic connective tissue most marked about ducts.
4. Dilated tubules containing exudate and desquamated epithelium.

ment that it will require from three to six months before he is cured, for if he knows at the outset the length of time needed he will be less apt to grow impatient at the apparent slowness of his progress and abandon treatment before he is well.

## CONSEQUENCES OF UNCURED GONORRHEA

**To the Man.**—(*a*) *Local.*—

The more remote effects of gonorrhea have an important influence on the general economy. The local lesions of prostatitis and seminal vesiculitis are followed by a train of nervous symptoms and attended by a condition of impotence; epididymitis generally results in sterility; if a stricture occurs in the urethra, it may be followed by impotence and all the serious consequences of obstructed urinary outflow, and in the most recent times some connection is thought to exist between a gonorrhea and the development in old age of a hypertrophied prostate.

(*b*) *General Affections.*—The discoveries of the past few years in connection with the gonococcus have demonstrated that gonorrhea is not a purely local disease, but it may be regarded as a systemic general infection, with local manifestations, for the gonococci are carried through the lymphatics and deposited in various serous membranes. A common manifestation of this infection is noted in the inflammation of white fibrous tissue of joints and the endocardium and pericardium, but the meninges of the brain and cord may also be attacked.

The kidney also suffers and a pyelitis may develop, either as a result of the direct local extension from the urethra, or perhaps from hematogenous infection.

The *duration* of gonorrhea depends on the longevity of the gonococcus, and this organism may live for years after its first introduction into the body.

Morrow reports one case of contagion four years after infection, and another one after six years.[1]

**Effects Upon the Female.**—The consideration of the effects of gonorrhea upon the female may be considered under three heads:

(*a*) The increased risk to the life and health of the woman.

(*b*) The effects in inducing sterility.

(*c*) The effect upon the infant, in causing abortion, premature birth, ophthalmia neonatorum, and blindness.

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[1] Morrow, Prince W.: Social Diseases and Marriage, 1904.

**The medical profession has not accepted its share of responsibility for these results!**

**Physicians are too apt to allow a patient showing but slight symptoms to marry, either from careless examination or an unwarrantable ignorance of the symptoms of an uncured gonorrhea and its serious consequences to the wife and mother.**

**In most cases of postmarital infection, the men have honestly believed themselves cured, and in many cases they have been assured that it was safe for them to marry.**

**The physician fails in his duty if he does not satisfy himself, by rigorous and exhaustive tests, of the patient's freedom from contagion before he sanctions marriage, and if he does not enlighten the patient fully and thoroughly as to the dangers to which he will expose his wife from the terrible complications of gonorrhea, until he can carry out his intentions with safety.**

Long before the discovery of the gonococcus, Noeggerath recognized the pathogenic influence of gonorrhea upon the pelvic organs of women, and boldly incriminated latent gonorrhea in men as the active factor in the production of these inflammations and the oft-resulting sterility.

At the time, his views were held to be wild vagaries, but at the present day we know that he was right.

While the pathogenic organism is the same in man and woman, the effects of the activity of the gonococcus are differently shown, on account of the material differences in the female genital organs. The greater extent of the tract in women permits a larger field for infection, by continuity of tissue.

The situation of the uterus and ovaries in the pelvic cavity, and their proximity to the peritoneum, all increase the gravity of the infection with the gonococcus. This is also further modified by the periodical congestion at the menstrual period, and especially the changes induced by the puerperal state.

The source of infection in women is almost invariably *chronic gonorrhea* in the man, for the reason that in acute gonorrhea coitus is painful, and also because most men have enough conscience to abstain from intercourse during the acute period.

In chronic gonorrhea, however, the symptoms are very trifling and may be easily overlooked.

The infection may take place in the vagina, but more frequently the organisms are deposited in the cervix at the time of ejaculation.

The inflammation remains localized for a time, until the congestion of the menstrual period or pregnancy determines the extension of the process.

The inflammation then ascends, and the endometrium, tubes, ovaries, and eventually the peritoneum are in turn attacked.

The disease is insidious while in the endometrium, and often occasions only trifling symptoms, and the woman is entirely unconscious that she has a serious infection until the tubes or ovaries are attacked.

Another reason why the infection is overlooked, is because in men the gonococci, after propagating for months upon the same soil, lose their extreme virulence, and when transplanted to the female their action depends upon the accident of their location.

If their new habitat is the urethra, they find a favorable soil and develop active inflammatory symptoms; if the primary infection is in the cervix, they are more apt to pursue a torpid, slowly proliferating character, for the reason that some special excitation is required to arouse them from their dormant, inactive state and endow them with exalted virulence.

The determining cause is found in the function of menstruation, which causes congestion and increased flow of mucous secretion, and the lochia constitutes an excellent culture medium for the gonococcus.

It is a well-known fact that a woman with gonorrhea may be innocuous as far as contagion is concerned during the intermenstrual period, but becomes highly contagious immediately after the menses.

When the gonococci gain entrance to the body of the uterus or endometrium proper, general symptoms develop which are more or less pronounced, and with marked exacerbations at each menstrual period, and attended with an increase in the menstrual discharge for some days after the period.

As a result of the changes briefly mentioned, sterility occurs in 50 per cent of the cases, and a condition of invalidism is brought about, which makes life a burden and deprives the home of her influence and care.

The conditions above outlined are discussed fully in the treatises on gynecology, but it seems appropriate, before dismissing the subject of gonorrhea, to call attention to the conditions which may arise, through ignorance or carelessness on the part of a physician when consulted by a candidate for matrimony.

# CHAPTER XVI

## COMPLEMENT-FIXATION TEST IN THE DIAGNOSIS OF GONORRHEA

In recent times another resource in the diagnosis of gonorrhea, especially in the chronic form, has been placed at our disposal in the complement-fixation test by Schwarz and McNeil first described in an article published in 1911 in the *Journal of the Medical Sciences.*

The value of this test has been well summarized by Williams as follows:

To be of much practical value, the gonococcus complement-fixation test must be conducted with a polyvalent antigen and the hemolytic indicators must be carefully adjusted and repeatedly titrated.

The test is absolutely specific for the gonococcus. In no infection, other than gonococcal, has a positive reaction been obtained. Thus, it is more specific than the Wassermann test is for syphilis.

A positive reaction is always reliable and an indication of a gonococcal infection somewhere in the body. The only exceptions are when the serum is obtained from an individual who has recently received gonococcic vaccine or has just recovered from a gonorrheal infection and the immune bodies have not yet been eliminated—a variable length of time but probably not exceeding two months.

The test is of particular value in suspected gonococcal infection in which the gonococcus can not be discovered bacteriologically. In doubtful cases, the only proof of a specific infection is the cultivation of the gonococcus. As a matter of technic, the acquiring of the gonococcus in culture, owing to its susceptibility to cooling, its association with other rapidly growing organisms, and the need of special media, is much more difficult than the fixation test. Except in acute cases, where the gonococci are abundant, the positive evidence produced by a Gram-stained smear should not be accepted as conclusive: among the sources of error may be mentioned the micrococcus catarrhalis, the diplococcus, crassius, irregular types of Gram-negative cocci, and most important of all are the so-called degeneration forms of staphylococci.

In interpreting a positive test, it should always be borne in mind that gonorrhea is a very widespread disease and that an individual may suffer from at least two different infections.

A positive reaction occurring in a patient supposedly cured of gonorrhea, indicates the presence of a gonococcal focus and the capability of infecting others. The importance of this in connection with marriage is great. A positive reaction occurs in about 20 per cent of those clinically cured.

In acute cases, in which the gonococci are usually easily demonstrated, the test is generally negative. Contrarily, in the chronic and ill-defined affections, where it is not usually feasible to obtain the organism, the test acquires its greatest sensitiveness.

A negative reaction does not exclude gonococcal infection, especially in the acute and subacute stages, without complications, when it is limited to the urethra or vagina.

Syphilis or a positive Wassermann reaction does not interfere with the test in any manner.

It is of particular value in the diagnosis of gonorrheal arthritis, giving about 100 per cent positive reactions.

Gonorrheal epididymitis, at least by the fifth week, also gives about 100 per cent positive reactions.

Chronic posterior urethritis, prostatitis and seminal vesiculitis, with recurrent exacerbations, give about 75 per cent positive reactions.

Pyosalpingitis gives about 65 per cent positive reactions.

About 65 per cent of all stricture cases give positive reactions.

In gynecology the test has proved its value in the differential diagnosis of pelvic inflammatory diseases from one another and from neoplasms. The test is usually negative in uncomplicated cases of urethritis, vulvovaginitis, and bartholinitis; it appears that the infection must reach at least to the level of the uterus before a positive reaction occurs.

## BIBLIOGRAPHY

De Keersmaecker and Verhoogen: Chronic Urethritis, 1901.
Finger, E.: Die Geschlechts Krankheiten, 1908.
Luys, G.: Gonorrhea, 1913.
Oberländer and Kollmann: Die Chronische Gonorrhea, 1901.
Oberländer and Neilsen: Path. and Ther. Chron. Tripper, 1888.
Saxe, De Santos: Study of Shreds. Philadelphia Med. Jour., 1907.
Schwarz and McNeil: Jour. Med. Sc., 1911.
Wossidlo: Die Gonorrhoe, 1909.
Idem: Post Urethritis, 1913.

# CHAPTER XVII

# GONORRHEA IN WOMEN

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## General Remarks

In 1872 Emil Noeggerath published a work on gonorrhea which was destined to revolutionize the view of the medical world regarding the clinical significance of the disease, more especially of gonorrhea in the female. He was the first man to insist that inflammation of the uterus and its appendages was the direct result of gonorrhea and that gonorrhea was extremely intractable to treatment, that it often remained latent for months or years before causing severe complications, and that infection as a result of sexual intercourse might result after long periods of quiescence.

He made this statement: "A woman who at any time in her life has had an acute gonorrhea has to expect at some more or less distant period—it may be a month or a year—a subsequent attack of peritonitis in some form," and that "the wife of a man who has ever suffered from gonorrhea is with regard to an attack of perimetritis, or cellulitis, in the same position as if she herself had had an acute gonorrhea." He dwells strongly on this point and goes on to say: "The young, hitherto healthy wife, begins to complain a few weeks after marriage. Menstruation commences to be more profuse than formerly, accompanied by a dysmenorrhea. Leucorrhea becomes more or less excessive, especially after the periods. This gradually increases, ultimately becoming continuous, without intermission, until the next menstruation begins. After a few months, severe pain commences in either or both sides of the pelvis and the sufferer is ultimately compelled, on account of fever and unbearable burning pains in the abdomen, with increased leucorrhea, to take to her bed and send for medical assistance."

These may have been the viewpoints of a pessimist, and while the author is not personally *extremely* pessimistic regarding the treatment of gonorrhea in women, he is very careful in making the statement that an individual patient is absolutely cured of her infection, and the necessity of protracted treament should be impressed upon every medical man.

The genitourinary men of the present day who have confined their practice almost entirely to the treatment of gonorrhea in the male, are very much in advance in their methods of physicians under whom the women come for the treatment of their gonorrheas with the complications. Unfortunately, the treatment of gonorrhea in the female is confined almost entirely to the general practitioner, and this condition of affairs has not led to much advance in our treatment of these cases.

## Infection

Gonorrhea is usually contracted through sexual intercourse, although instances are not lacking to show that at times patients have been contaminated through dirty instrumentation.

Accurate statistics relative to the period required for the incubation of gonorrhea in women are obtained with difficulty, as the initial symptoms of this disease in the female are often so slight and of so insidious or transitory a character, that the actual date of onset is difficult to determine definitely, and, as a further hindrance, the onset is, as a rule, so mild that the physician is rarely consulted until the disease has made considerable progress. In fact, when the infection is confined to areas below the internal os it is not uncommon for patients to be in ignorance of the existence of the disease.

It is a well-known fact that a female gonorrheic can transmit infection at one time and not at another. They are more liable to produce an infection directly after a menstrual period. A curious feature is shown by the fact that a husband may infect his wife and practice abstinence during the course of the treatment of his disease and may, upon resuming marital relations, be inoculated by her and develop an attack, perhaps more severe than his original one; or husband and wife may both suddenly manifest severe symptoms. The lack of knowledge of this peculiarity of the microorganism has frequently led to accusations of infidelity.

## Pathology

The gonococcus produces an endotoxin which sets up an acute inflammatory reaction. This toxin is said to be set free from the body of the organism at its death. The inflammation spreads along epithelial-lined surfaces without, as a rule, producing necrosis of the epithelium, but this may occur, and then the inflammation quickly extends to the underlying tissue, and necrosis and abscess formation may follow.

The gonococcus, though normally an organism which lives on mucous membranes, is able to penetrate into the tissues and into the blood; thus a gonorrheal septicemia may arise.

In women the seriousness of gonorrhea is enhanced by the far-reaching local injuries it produces, and by its persistence, in spite of treatment, being acute to start with, tends to become less active and to persist in a chronic form for years.

The effect of the toxin on the fibroblasts is to cause them to throw out an abundance of collagen, which produces scar tissue and contraction.

The anatomic structures in the female most frequently invaded, which can be reached by a treatment other than operative, are, the urethra, Bartholin's glands, the glands about the vestibule, the cervix, and less often than the others, the vagina, unless the patient is a child.

In an extension of the disease above the cervix it extends by direct continuity along the endometrium and along the mucosa of the tube. The most frequent pathologic condition produced by a gonorrheal infection of the tube is a pyosalpinx. Gonorrheal lesions of the fallopian tubes possess certain characteristics that while not sufficiently absolute to prove the etiology of the infection, are pronounced enough in the great majority of the cases so that we may be moderately certain of the type of infection present. The fact of the extension of the gonococcus along the surface mucosa produces certain macroscopic pictures that are more or less characteristic. Whereas pyogenic microorganisms reach the tubes by way of either the blood vessels or lymph vessels of the broad ligament, the mucosa is not primarily invaded. In these infections ovarian abscesses and cellulitis are common, while from the very nature of the gonococcal invasion, these structures are less frequently involved. When the end of the fimbriated extremity of the fallopian tube has not been closed through the inflammatory result of the primary gonococcal infection, the ovary may become infected secondarily, a perioophoritis resulting. In the pelvis, inflammatory disease (perioophoritis) is the most frequent pathologic condition of the ovaries found. When the substance of the ovary itself is infected, the most frequent route of infection is through a recently ruptured follicle. Such ovaries are rarely larger than a hen's egg, and are often but little increased in size. During the chronic stage sclerotic changes are common and the ovary may be even smaller than normal. As a rule, multiple retention cysts are present. A frequent result of a gonococcal infection of a tube is a hydrosalpinx.

## Symptomatology

The symptomatology when the patients are seen early is that of an acute inflammation, differing according to the anatomic structure invaded, and as often only Bartholin's glands, the vagina or the cervix are invaded, many women have no symptoms of a urethritis.

The honeymoon gonorrhea, where the man, out of courtesy to his young wife, does not wish to cause her pain and does not rupture the hymen at the first intercourse, is usually the most extensive infection that we find in women, as the infectious semen is deposited at the orifice of the urethra and at the openings of Bartholin's glands. As a result, an acute vestibular gonorrheal urethritis and Bartholinitis occurs. This condition causes, of course, considerable pain, and intercourse ceases. If a woman were seen in this condition by a competent physician, she could easily be treated and the spread of the disease prevented, but most of these patients do not consult a physician on account of a sensitive modesty. As a rule, they employ douches and in this way carry the infectious material from the outside into the vagina, and thus transfer the disease to the cervix.

## Diagnosis

In examining a case of suspected gonorrhea in the female, anamnesis is of particular importance. Especial attention should be directed to the menstrual history, inquiries being made concerning changes in the character of the flow and the development of a dysmenorrhea. Inquiries should be instituted concerning the existence of vesical irritability, frequency of urination, dysuria and cloudiness of urine. The possibility of previous attacks of pelvic peritonitis, as well as of dyspareunia and painful defecation, should be inquired into.

If the patient is a married woman, the questions should be so framed as to be entirely free from all suggestions of a marital contamination. It is impossible to estimate correctly the discharges of any patient from the urethra unless she has been instructed not to urinate for several hours previous to the examination.

After the clinical symptoms of gonorrhea have subsided, all patients should be subjected to a thorough bacteriologic examination; Norris says at least three. In the author's service at the Kings County Hospital we insist upon five negative smears in the adult and seven negative smears in children, before we will sign them out as cured.

If the patient is unmarried, she should be instructed to return for further examination when contemplating matrimony, or on the first appearance of any symptoms suggestive of a recurrence of the original condition. In married patients the greatest care should be exercised to obtain a complete cure before marital relations are resumed.

In dealing with female gonorrheics the position is often an extremely difficult one, especially if the patient is a married woman. Under no circumstances should the patient be left in ignorance as to the infectious nature of her disease. On the other hand, care must be taken not to arouse suspicion of marital infidelity in a case that might possibly be the result of an extragenital infection. No rule can be laid down to govern all cases. Common sense and tact are the essentials. An endeavor should be made to have the husband consult a genitourinary surgeon, as it is absolutely futile to attempt to cure a gonorrhea in a woman whose husband is afflicted with a neglected or chronic gleet or other form of Neisserian infection and who is constantly reinfecting his wife.

The intensity depends largely upon the site of infection, slight so long as it is confined to the urethra, cervix, or other parts below the internal os, becoming severe the moment it goes above this point. The acute stage, soon over, pain is forgotten, slight discharge is left, the woman and her mate are immune to each other, and the discharge is ignored. The woman thinks it a part of her married life and does not consult a doctor; but if an acute illness comes along it may so lower her resistance that the chronic infection will travel upwards and she will begin to have tional disturbances of menstruation and ovulation, dı secondary infections of the endometrium, body of the uterus, or appendages. Gonorrhea does not by any means always lead to sterility. The frequency of ophthalmia neonatorum proves this, but, of course, conception can never occur after closure of both tubes.

## Clinical Data

The collection of material for the necessary laboratory examinations in the acute gonorrheal inflammations presents no particular difficulties, but when we have a case of subacute, or chronic, gonorrhea, or a case suspected of having had a gonorrheal inflammation, owing to the so-called gonorrheal relics, a knowledge of the lurking places of the gonococcus is presupposed. These are all of the anatomic orifices and crypts appertaining to the external genitals and the cervix. These comprise the urethra, with the opening of the periurethral glands on its floor, the openings of Skene's glands, the opening of a gland, to which hitherto no attention has been called, but which is located geographically at the meatus, or just within the meatus, but in contradistinction to being on the floor, as are Skene's glands, it is located on the roof of the canal. The author has frequently found an infection of this gland without a complicating infection of Skene's glands.

A chronic infection of the glands near the meatus (nongonorrheal) often results from the habit which women have of wiping themselves from the vagina forward after urination.

As to the methods of obtaining a smear: von Giesen has compared the results obtained by the use of a cotton swab with those secured by using a medicine dropper, and found that with the latter a considerably larger proportion of positive results were obtained. This applies only to the acute conditions. In the subacute and chronic conditions, where it is extremely difficult to find the organism, Schultze's method of thoroughly cleansing the vagina and placing a sterile tampon against the cervix will frequently give a smear within a few hours which will be positive. The platinum loop is a valuable instrument to use in the chronic cases in place of the cotton swab, or, where there is difficulty in obtaining a smear, a small, sharp curette can be used, especially in obtaining smears from the cervix. A careful study of an individual case requires *smears* from the *urethra*, from the *glands located at the meatus*, from *both Bartholin's glands*, from the *vagina* and from the *cervix*.

ld either be initialed or numbered, in order that the findings may be positive as to the anatomic location of the infection. In the chronic cases, after having obtained a specimen, the usual pelvic examination can be made, especial attention being directed towards detecting adhesions of the uterus or its appendages and enlargements or lesions of the latter. If the patient is a virgin, the intravaginal manipulations necessary for obtaining a smear can usually be performed through a large-sized endoscope without resulting injury to the hymen.

A method of obtaining urethral secretions used by the author is the milking of the urethra from above downward to its lower third by means of one finger, and then substituting the tip of the thumb in milking the lower third. In investigating the nabothian follicles they must be punctured by a sterile scalpel, or better, by means of a cautery, in order that the secretion may be allowed to escape. Extreme care should be taken to avoid contamination of the smear from one area with that from another.

### Treatment

The treatment depends entirely upon the stage of the disease. In the acute stage practically all that is demanded is absolute rest, a light diet, particularly about the time of the menstrual period, and great care should be taken in the methods of obtaining cleanliness not to transfer the infection farther along the genital tract than the original infection. Chronic cases require much patience on the part of the physician and the patient as well. Different men have favorite remedies which are used. The silver salts are the favorites of most authorities. In the treatment of the urethra the endoscope is invaluable. The author finds that Skene's glands are best treated by means of the actual cautery. The glands of the vestibule also yield more readily to this form of treatment. Infections of Bartholin's glands may yield to injections of the silver salts, or it may be necessary to dissect them in their entirety. He also uses the cautery in the treatment of chronic gonorrheal conditions of the cervix, making linear cauterizations of the cervical canal once in about ten days or two weeks. When the uterine endometrium has become infected, and an extension to the appendages can be ruled out, he believes with Boldt that the only treatment that offers any cure is a thorough curettage and treatment of the curetted uterus by means of iodine or some silver salt. Treatment of the tubes and ovaries should be conservative over a sufficient length of time until the conclusion is reached that operative measures imperative, and the author believes too early operation is the greatest cause of attacks of pelvic peritonitis following operation upon these conditions.

Dysuria can be best relieved by the use of a mixture containing 10 grains of bicarbonate of potash and 20 minims of tincture of hyoscyamus to each dose.

Regarding conservative or complete surgery in these cases, one must be guided by the individual conditions which one meets, explaining to the patient that conservative surgery may mean future pregnancies, or perhaps future operative procedures. As to whether one should, when doing radical surgery, do a supravaginal or a panhysterectomy will depend upon the condition of the cervix at the time of operation. If the cervix shows the. result of the gonorrheal infection by an extreme endocervicitis with erosions, or if the patient is a married woman and has had children with the resulting lacerations, a panhysterectomy should be done.

## GONORRHEA OF SPECIAL ORGANS

**Gonorrheal Vulvitis** is not often encountered among adults owing to the difference in the histologic structure of this region from that of children. The most frequent occasions where it is found are those cases of so-called honeymoon gonorrhea mentioned under General Remarks. The symptoms are those of an acute inflammatory condition elsewhere. The tissues are red, swollen, edematous and tender, and covered with a profuse purulent discharge. Occasionally infection of the hair follicles or sweat glands occurs. Condylomata acuminata and inguinal adenitis may complicate the condition. There is itching and burning about the external genitals and burning urination on the passage of the urine over the inflamed areas. Walking and any friction are among the subjective symptoms. There may be a moderate temperature with constitutional symptoms.

The treatment is rest in bed and light diet, with absolute freedom from spiced foods or alcohol in any form, with cleanliness as an essential feature. This can only be carried out by having the hair shaved from the parts, having frequent washings with either sterile water or a mild solution of borax, permanganate or bichloride, according to the individual preferences.

In all acute conditions of this type the patient should be informed of the extreme infectiousness of the material and instructions given that dressings should be burned.

Condylomata acuminata, or venereal warts, may be caused by gonorrheal or other discharges, but are frequent complications of a gonorrheal vulvitis. They do not vary in pathology from the same conditions in the male and usually subside with the subsidence of the vulvitis. If they persist it is sometimes necessary to remove them surgically, or they can sometimes be removed by frequent applications of a 12½ per cent solution of bichloride and alcohol. When applying this the surrounding parts should be protected by means of vaseline.

**Gonorrheal Urethritis** is a frequent location of gonorrheal infection in women.

SYMPTOMATOLOGY.—In the acute condition there is a tickling, burning sensation in the urethra, with burning urination, with, subjectively, redness, pouting of the meatus, and a profuse mucopurulent discharge in which the gonococci are found.

Chronic gonorrheal urethritis presents particular difficulties as to proof of its existence, as in the pus stripped from the urethra or periurethral glands it is extremely difficult to find the gonococcus, although frequently the laboratory will demonstrate diplococci resembling the gonococcus, which are located extracellular, and are Gram-negative, but do not partake of the morphologic characteristics of the gonococcus, but with a previous history of an acute condition one is justified in treating it as a gonorrheal condition which has become chronic.

We frequently find patients who will complain from time to time of burning urination where the only lesion that can be found is a chronic infection of Skene's glands. This was undoubtedly primarily of gonorrheal origin, but the gonococcus can not often be found in the chronic condition.

The infections of Skene's glands and the anterior gland mentioned under Clinical Data, are best treated by means of the actual cautery. In the treatment of the remainder of the urethra the endoscope is invaluable. Through it applications of silver nitrate, 10 grains to the ounce, to the entire urethra, or for erosions present along its tract, can be made. This should be done not oftener than once in seven days.

**Bartholinitis.**—Infection of Bartholin's glands is sometimes unilateral, but usually bilateral, and may result in the acute condition and abscess formation, when this occurs the local symptomatology of an acute inflammatory condition is presented.

Treatment of the acute condition is wide incision and drainage just at the mucocutaneous junction. After incision the sac should be well packed with gauze.

The chronic conditions of infection of Bartholin's glands with the gonococcus may result in cystic formation from the blocking of its duct. This condition requires a complete dissection of the sac with closure and a small drain in the lower end of the wound; but at times it is possible to excise the sac so completely that no drainage will be necessary.

Another frequent condition of inflammation of Bartholin's gland is a thickening of its sac, which can be detected with one finger within the vagina and the thumb just outside the macula, also so-called macular gonorrheica of Sänger, due to the irritating passages from the mouth of the duct. This can be treated by means of an application of a mild nitrate-of-silver solution, introduced into the duct through a blunt hypodermic needle.

**Gonorrheal Cervicitis.**—Gonorrheal infection of the cervix is more frequent than gonorrheal infection of the urethra, owing to the fact that gonorrhea is usually communicated through coitus. In the acute condition there is a sense of fullness and weight in the vagina, with a profuse discharge. The cervix is reddened. The chronic condition must be diagnosed in the multipara from the form of cervicitis resulting from a laceration of the cervix, and in the nullipara from that due to cervicitis complicating other conditions.

The treatment of the acute condition is rest in bed and cleanliness.

When it becomes chronic, the author has achieved the best results by the use of the actual cautery, doing a local cauterization once in ten days. The accompanying infections of the nabothian follicles are also best treated by means of the actual cautery.

Gonorrheal endometritis and metritis are evidenced by a profuse mucopurulent or purulent discharge, with, subjectively, a feeling of heaviness in the pelvis and vagina and tenderness over the lower abdomen, with a boggy uterus which is tender to abdominal examination.

The treatment of the acute condition is rest in bed and cleanliness, but when the condition becomes chronic, and infection of the appendages can be ruled out, dilatation and curettage with the application of iodin to the interior of the uterus, is indicated.

**Gonorrheal Infection of the Tubes and Ovaries.**—The symptoms are those of an acute infection within the pelvis, with temperature and constitutional symptoms. As the infection is usually bilateral, there is tenderness over both sides of the abdomen, with rigidity of the muscles, making it practically impossible to map out the tubes.

In the chronic condition there is a history of frequent mild attacks of pelvic peritonitis, with semi-invalidism, menstruation becomes painful, and the woman is apt to be sterile.

The treatment is conservative—douches and tamponade, with the application of tincture of iodine and glycerin until such time as there is no longer any progress toward ultimate recovery, when surgical interference becomes necessary. Surgery should consist, if a cure is to be promised, of extreme radicalism. There should be no surgical conservatism unless the probability of future operative interference is explained to the patient and her family.

**Gonorrheal Peritonitis.**—The symptomatology consists of a rise of temperature, with pain over the lower abdomen; or, if it is general, over the entire abdomen. It may result fatally or subside, leaving a matting together of the organs of the pelvis.

The treatment is rest in bed, Fowler position, and the use of an ice coil or ice bags, opium to relieve the pain and liquid diet. The bowels should be moved whenever necessary by means of a rectal enema, and not by the administration of cathartics.

Frequently a mistake is made in diagnosis and a gonorrheal peritonitis is opened for some other acute condition. The tubes are found reddened, congested and swollen, with free pus dripping in the open end of the tubes. *These tubes should not be removed,* and the abdomen should be closed, for if the tubes are once removed, the patient is, of course, sterile. The author has frequently followed out this procedure with no ill effects whatsoever.

Gonorrhea of the anus and the rectum are infrequent conditions, but should always be borne in mind when investigating the cause of trouble in these parts. The symptoms do not vary except as to location.

## GONORRHEAL VULVOVAGINITIS IN CHILDREN

Gonorrheal vulvovaginitis in children generally occurs among the poorer classes because of overcrowding and unhygienic roundings. It may be propagated accidentally by a precocious sexual intercourse, and in rare instances, by the passage of a child through the infected maternal birth canal. This is especially true in breech presentations. The large majority of cases are infected accidentally by means of infected towels, bed-linen, wash-cloths and syringes. The circular toilet seat, so commonly used in our public schools, was mentioned by the author several years ago as a possible source of infection, and recently Taussig, of St. Louis, has come forward in an article written by him agreeing with this idea. The use of a seat with the central portion of the front removed, would act as a great prophylactic measure in institutions and public toilets. Epidemics frequently occur in institutions and can usually be traced back to some carelessness in admitting a child with an undoubted vaginitis to the general wards or beds. In many modern institutions no children are admitted to the general ward without an examination for vaginitis, with bacteriologic laboratory findings if indicated. This has prevented many epidemics, although they do still occur through carelessness on the part of some of the attendants.

Cases differ markedly in severity. Some are subacute; still in others the acute stage presents serious symptoms. In the mild cases there is only a slight itching or burning. Ardor urinæ is present. Still in others the symptoms are so severe that the patient must go to bed and lie with the thighs widely separated to prevent pressure upon the inflamed parts.

The author has only seen one case of undoubted infection of the peritoneum in a large series of cases. This child was extremely ill and one year after its discharge from the hospital still presented intracellular gonococci and diplococci Gram-negative in the vaginal discharge.

The amount of discharge varies from a slight mucous discharge, with redness, to a yellowish purulent discharge, sometimes tinged with blood.

In long-standing chronic cases the demonstration of the diplococcus is extremely difficult and often impossible.

The redness and swelling around the labia may result in partial gluing together of the lips of the vagina. Examination during the acute stage is painful. Examination of the vagina of these little patients during the chronic stage, if it is necessary, can best be carried out in the knee-chest posture with the aid of a small

The acute inflammatory symptoms usually last from three to six weeks, after which the discharge becomes more scanty and the pain disappears, or becomes alleviated, and a similar redness of the external parts, with a slight serous discharge, is all that can be found.

The diagnosis rests, of course, upon the finding of gonococci in the discharge, but whether or not they are found, all vaginal discharges in children should be treated with suspicion and as if they were of gonorrheal origin. The parents or nurse should be instructed as to possible contamination, and rigid cleanliness and antisepsis should be carried out.

## Treatment

In the acute condition the treatment consists of cleanliness and great care that the infection be not carried higher.

In the chronic condition relapses are frequent, and applications of mild solutions of silver nitrate, not over 10 grains to the ounce, should be made to the vagina and cervix through an endoscope, and after the gonococci have disappeared from several successive smears, the use of a mild astringent douche by means of a small, soft-rubber male catheter, will clear up the remaining serous discharge.

# CHAPTER XVIII

## INFLAMMATIONS OF THE PROSTATE

### ANATOMY OF THE PROSTATE

The prostate in shape and size resembles a horsechestnut, and is situated below the bladder and perforated by the prostatic urethra. It is surrounded by a dense, fibrous capsule, which sends thin septa inward, between the glands and among the muscle fibers.

The prostate is essentially a *glandular organ* and is composed of two elements:

(*a*) A fibrous connective-tissue framework, and unstriped muscular fibers, and

(*b*) Glands, composed of compound branching tubules called acini and lined with secreting epithelium of the cylindrical variety, each containing a nucleus in its lower third and ending in short *ducts*.

Small, oval bodies are occasionally found within the tubules, which are known as *amyloid bodies*. They are formed from the secretion of the prostatic tubules and broken-down cells; later they may become calcified and form *prostatic concretions*.

According to the recent investigations of Lawsley[1] the prostate is composed of five lobes which he describes as follows: the middle lobe situated between the bladder and the ejaculatory ducts under the floor of the urethra. Lateral lobes, or those parts of the gland which arise from the prostatic furrows and lateral walls of the urethra; prostatic lobe, or that part of the prostate which lies dorsal to the ejaculatory ducts above their entrance into the urethra—this is the point of the prostate which is felt per rectum. Ventral lobe formed by glands arising from the anterior or ventral wall of the prostatic urethra.

The ducts of the prostatic tubules are more numerous than formerly supposed, and range in various specimens examined from forty to seventy. They empty into the urethra in groups from the nearest point to their respective lobes.

The prostate is tunneled by the ejaculatory ducts from the seminal vesicles, and which empty by a slit-like orifice into the posterior urethra, within or at the sides of a small depression at the base of the verumontanum, or colliculus seminalis.

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[1] Medical Record, July, 1916. Jour. Am. Med. Assn., Jan. 11, 1913.

## SECRETION OF THE PROSTATE

The prostatic secretion is a thin fluid, milky in appearance and alkaline in reaction, with a peculiar odor which it imparts to the semen.

It serves to dilute and render less viscid the secretion from the testicles and seminal vesicles, and exerts a nutritional influence upon the spermatozoa, for observation has shown that the spermatozoa do not become mobile until they have come in contact with the prostatic fluid.

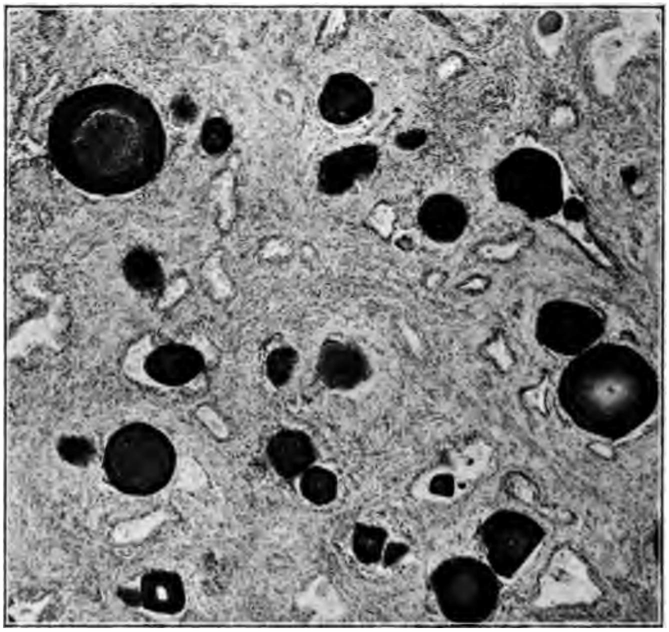

Fig. 102.—Section of normal prostate with amyloid bodies.

Whether this is due to a mere mechanical dilution of the semen, admitting free movements of the spermatozoa, or whether the prostatic fluid has some direct effect on their nutrition, is still under discussion. Under the *microscope* the normal prostatic fluid is found to contain cylindrical cells, some granular phosphates, and a little mucus.

On adding a 1 per cent watery solution of ammonium phosphate, *Böttcher's crystals* appear.

These are transparent, dagger-shaped crystals, and Fürbringer claims that their base exists only in prostatic fluid.

In consequence, the presence of these crystals after the addition of 1 per cent ammoniophosphate solution denotes that the fluid is derived from the prostate.

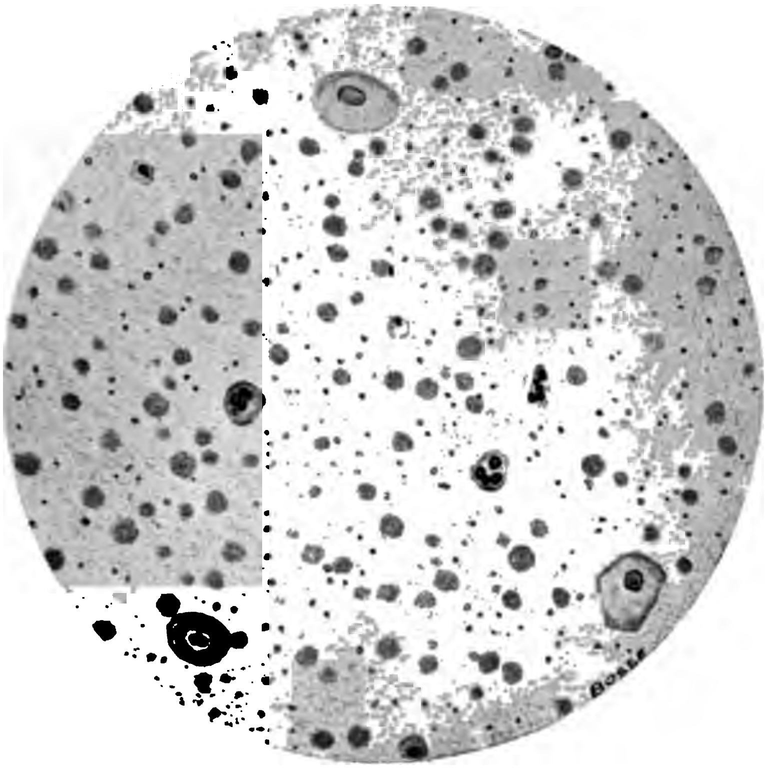

Fig. 103.—Normal prostatic secretion. Lecithin bodies abundant, granular phosphates, an occasional leucocyte, an amyloid body, and a few squamous cells from urethra or bladder. Original drawing from microscopic specimen.

# ACUTE PROSTATITIS[1]

## Etiology

Acute inflammation of the prostate is always due to its infection with microorganisms.

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[1] In the consideration of the acute and chronic forms of prostatitis, no reference will be made to the senile hypertrophy of the prostate, which occurs in old men and which is considered later in a separate section.

Ninety per cent of the cases occur in the course of an acute gonorrhea, from an extension of the posterior urethritis and entrance of organisms into the prostatic ducts.

Acute prostatitis is more common than is generally supposed. Frank[1] examined 651 cases of gonorrheal urethritis; of these, 210 had posterior urethritis, and in every one of these the prostate was diseased.

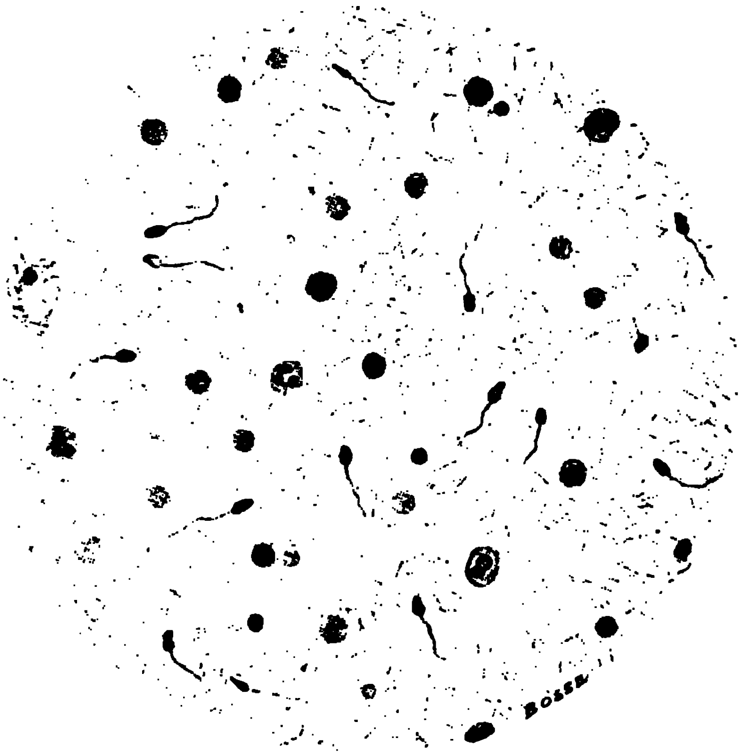

Fig. 104.—Normal secretion obtained by massaging the prostate and vesicles. Lecithin bodies abundant, a few spermatozoa, and an occasional leucocyte. Original drawing from microscopic specimen.

Acute prostatitis may develop early in the course of gonorrhea. In 96 of Frank's cases it developed in the first week.

The microorganism which is responsible is generally the gonococcus. In 210 cases of Frank the gonococcus was found 179 times, other bacteria 20 times, and an aseptic secretion with numerous leucocytes was found in 11 cases.

Acute prostatitis may develop in the course of a chronic gonorrhea, as a result of forced injections, injury with sounds, excesses in alcohol or venery, active bodily exercise, or a chilling of the surface from exposure to cold or wet.

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[1] Medical News, April 26, 1902.

Another predisposing cause to infection is the prolonged congestion of the prostate and posterior urethra, as a result of ungratified sexual excitement.

These causes all operate either by forcing organisms into the prostatic ducts, or lowering the local resistance of the tissues to infection.

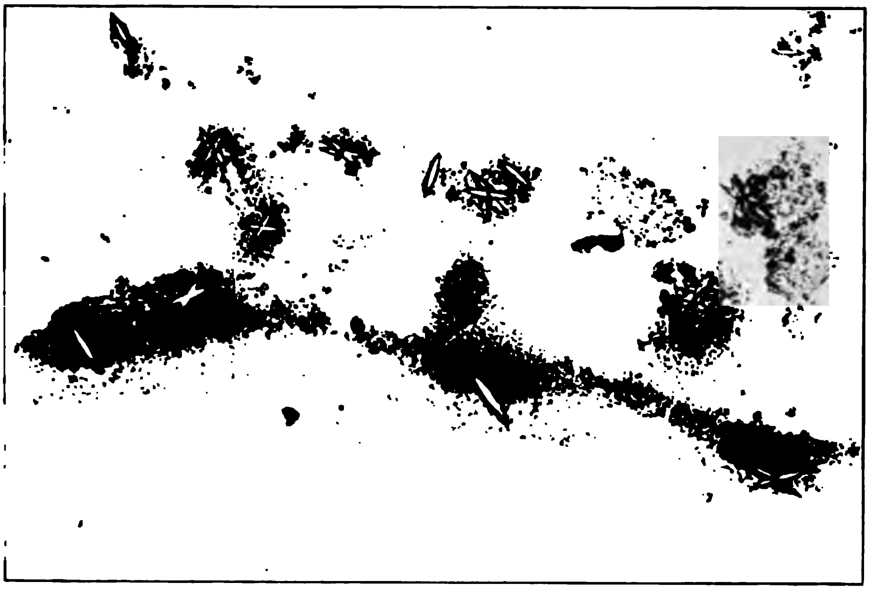

Fig. 105.- Böttcher's crystals.

In a very small number of cases acute prostatitis occurs as a result of the passage of the colon bacillus from the rectum or in the course of infectious disease by *metastasis.*

Acute prostatitis occurs in *three forms:*[1]

*I. Catarrhal prostatitis.*

*II. Parenchymatous prostatitis.*

*III. Suppuration of the entire prostate.*

It was formerly the custom to speak of **congestion of the prostate,** but this term is very vague and indefinite.

We do, however, meet with cases in which, in the course of a gonorrhea or after the introduction of a catheter, a distinct and painful enlargement of the prostate occurs, which is by some authors termed *congestion*. It is probably due to a small, round-celled infiltration, with serous exudation into the parenchyma, and subsides rapidly by absorption.

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[1] In the chapter on Acute and Chronic Prostatitis the author has made free use of the valuable monograph on the prostate by Socin and Burkhardt, published by Enke, Stuttgart, 1902.

## CATARRHAL PROSTATITIS

### Pathology

In this form of prostatitis, the prostatic tubules are *dilated*, their epithelial lining is infiltrated with round cells, and is the seat of catarrhal inflammation. The cavities of the tubules are filled with desquamated epithelium and altered catarrhal mucus.

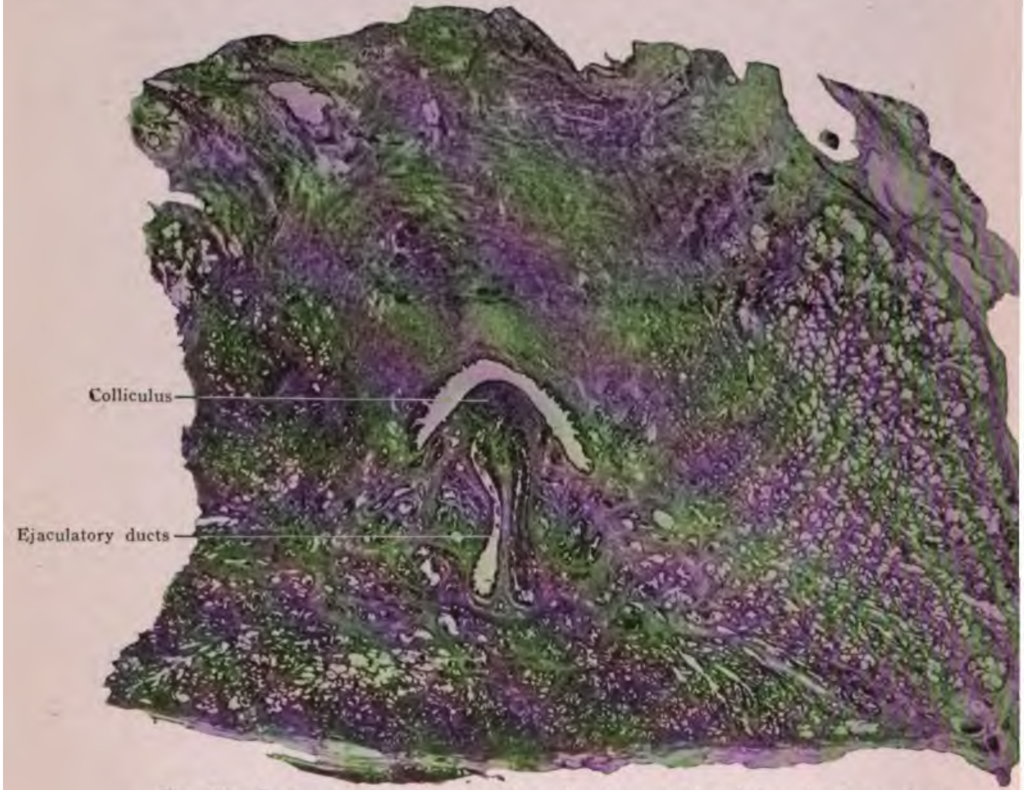

Fig. 106.—Section of prostate and urethra, showing prostatic tubules, ejaculatory ducts, and colliculus.

The intertubular substance of the prostate, the fibromuscular tissue, is the seat of a small, round-celled infiltration and serous exudation.

The above changes all lead to an enlargement of the entire organ, and on pressure a turbid white secretion (pus) is expressed.

*Healing* occurs by absorption of the fluid serous exudate, throwing off of the degenerated epithelium through the prostatic ducts, and regeneration of the epithelium.

### Symptoms and Course

The symptoms of this condition are not very well marked, and they are still further masked by the existing posterior urethritis. The patient complains of a sense of weight and heat in the perineum and pain on defecation and urination. The fever is usually slight, but may be considerable.

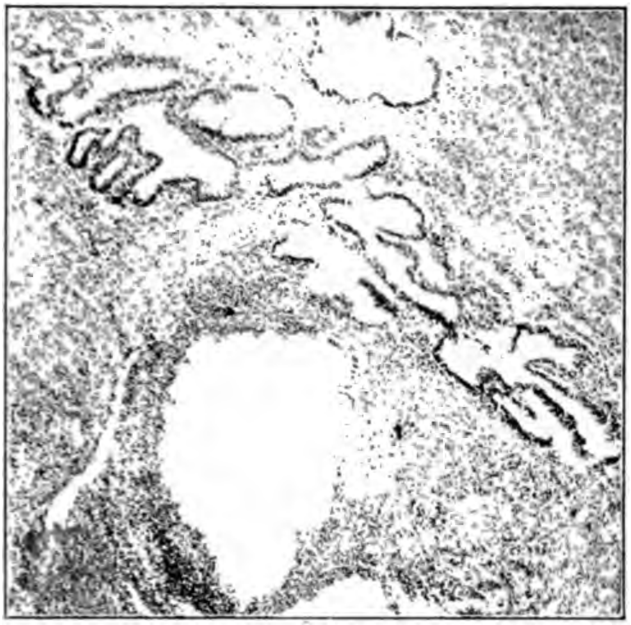

Fig. 107.—Acute prostatitis. Normal tubules and cystic tubules with pus.

On *examination* with the finger in the rectum, a hard, tense, sharply defined swelling is observed, and the borders of the prostate can be distinctly outlined.

The increase in size is variable, sometimes only one lobe is affected, and at other times the gland is not perceptibly enlarged and the diagnosis is only made by sensitiveness on pressure.

Catarrhal prostatitis generally heals through a discharge of the pus from the small abscess cavities into the urethra, and is followed by their subsequent cicatrization and closure.

Occasionally small foci of pus can become inspissated or calcified. The process may heal entirely or become chronic.

## PARENCHYMATOUS PROSTATITIS

This affection may begin as a *catarrhal prostatitis,* and increase, or begin at once as a parenchymatous inflammation.

### Pathology

Yellow foci of infiltration form near and between the glandular elements, which, after necrosis of the tissues, liquefy and form a few or many small miliary abscesses. These abscesses are sometimes absorbed, but more generally discharge their contents into the urethra, and the abscess cavities heal by formation of cicatricial scars, which contract and obliterate them.

Sometimes the abscess cavities do not close, but remain open permanently and communicate with the urethra by a fistula.

The cavity is the seat of chronic suppuration, and is prevented from healing by being filled with urine at each act of urination.

## SUPPURATION OF THE ENTIRE PROSTATE

This condition is always preceded by a parenchymatous prostatitis, but, instead of a spontaneous discharge of the small abscesses, several coalesce, form a large abscess, and destroy the entire lobe by a necrosis of the parenchyma.

The entire organ may be destroyed, so that it is converted into a pus sac, whose wall is formed by a fibrous capsule.

Such large abscesses generally break in the urethra, but sometimes outward in the neighboring connective tissue.

### Course

The fever is continuous and high. The pain in the perineum and rectum is very severe, and radiates to the penis, loin, and hips.

The pain is increased by pressure, and sitting is impossible.

There is a constant feeling as though a foreign body, like a nut, were in the rectum, which causes expulsive efforts on the part of the muscles and occasions rectal tenesmus.

If the enlargement of the prostate is considerable it can be felt on examination, bulging into the rectum as a diffuse, ill-defined, doughy or fluctuating swelling.

The protrusion of the prostate into the rectum causes the stools to be flat or ribbon-shaped.

Urination is often extremely painful, and if the greater part of the enlargement is directed upward toward the urethra the prostate presses upon it and causes *complete retention* of urine.

A blood count shows a high leucocytosis.

The swelling and enlargement of the gland reaches its height about the seventh day, and may terminate in the absorption of the inflammatory products and resolution; or, if the abscesses are small, they may discharge into the urethra and their walls undergo cicatrization.

In the cases which undergo *resolution* there is a gradual improvement in the symptoms. On the other hand, if *suppuration* takes place, an abscess forms in the center of the gland, and the formation of pus is announced by a throbbing pain in the perineum, and chills, followed by fever and sweating. If operative measures are not resorted to, the pus bursts through the capsule of the prostate and the abscess empties itself into (*a*) the urethra, (*b*) the rectum, (*c*) or through the perineum, (*d*) or may take an eccentric course.

The pus has been known to burrow its way through the abdominal cavity and finally empty through the inguinal region, the umbilicus, the sciatic foramen, at the edge of the false ribs, through the space of Retzius, etc.

Segond reports 102 cases of parenchymatous prostatitis which ruptured as follows:

- 35 times in the urethra,
  - 28 times spontaneously,
  - 7 times after passing catheter.
- 18 times into the rectum alone.
- 21 times into urethra and rectum.
- 28 times in various regions.

In various cases the fistulous opening may close by granulation, but feces, urine, or pyogenic germs may easily enter the fistula, and urinary infiltration, septic infection, and pyemia are not infrequent results. A perforation in the rectum or urethra may leave a permanent fistulous opening, with its attendant annoyances.

Parenchymatous prostatitis is a disease which is dangerous to life itself.

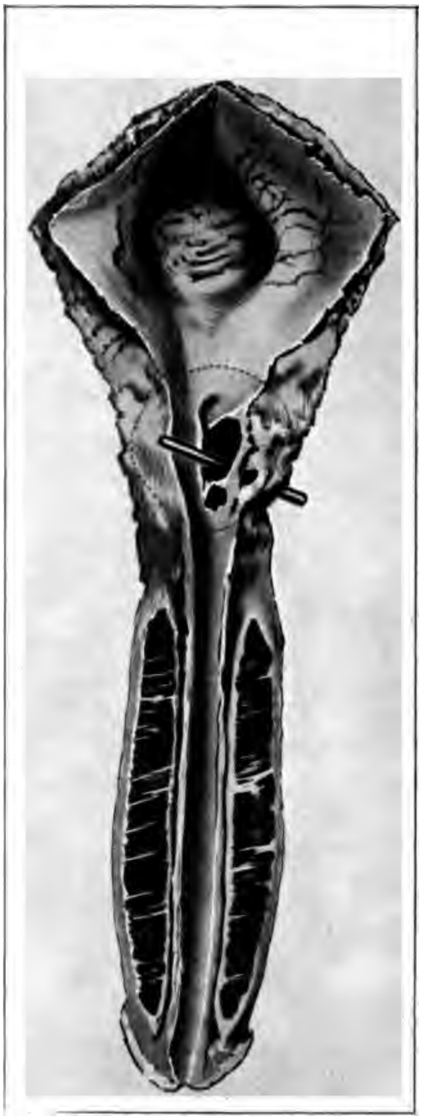

Fig. 108.—Abscess of prostate ruptured into urethra.

Segond's statistics of 114 cases show: 70 recoveries, 34 death 10 persisting fistulæ.

## Diagnosis

Parenchymatous prostatitis may readily be overlooked, and th case regarded as one of posterior urethritis, which is always pres ent and has similar symptoms, *unless rectal examination is made,* by which the enlargement of the prostate can be easily felt.

The prostate feels large, tense, and very painful. After a considerable portion of the gland has suppurated, a sense of fluctuation is usually perceived, but pus is present long before it can be detected by the examining finger.

A significant symptom of prostatic abscess, according to Alexander, is the *occurrence of a large amount of albumin in the urine,* entirely out of proportion to the amount of pus or blood present, and without existing renal disease, which disappears promptly on opening the abscess.[1]

The probable explanation is that, on account of the pressure on the veins, the blood serum is squeezed out into the posterior urethra and flows back into the bladder.

### Treatment

The indications are:

I. To lessen the severity of the posterior urethritis.
II. To prevent suppuration of the prostate.
III. If pus forms, to evacuate it promptly by incision.

The patient is put to bed, sandalwood oil is administered, and the pain and tenesmus controlled by opium. Locally either an ice bag or hot poultices are applied to the perineum, a safe guide for the choice between hot and cold applications being the sensation of comfort afforded to the patient.

Hot sitz-baths, from one-half to one hour two or three times daily, are always called for.

Continuous irrigation of the rectum with hot water, for half an hour at a time, by means of Kemp's tube is often useful, or Frank's rectal tube may be used instead. The instrument is introduced into the rectum and six or eight quarts of water, as hot as can be borne, are allowed through it.

If retention of urine should occur, the catheter must be introduced, but only when absolutely necessary, and, before catheterizing, the urethra should be well irrigated to free it from pus, which might be pushed ahead of the catheter into the bladder.

If great difficulty is experienced in introducing the catheter, it is proper to anesthetize the patient with ether and leave the catheter tied in the bladder, to obviate the difficulty of reintroduction. In extreme cases aspiration of the bladder above the pubes may be demanded.

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[1] Medical News, May 31, 1902.

In all cases in which the symptoms do not improve within the *first week,* but, on the contrary, the fever continues, the local symptoms grow worse, and rectal examination shows an increase in the size of the inflamed prostate, one can be sure that *abscess* is forming.

This serves as an *urgent indication* to give vent to the pus and allow it to discharge; for if the pus is allowed to burst through the capsule of the prostate spontaneously, it may burrow through the tissues and cause urinary infiltration and pyemia, or at least a fistula, which does not heal without operation.

For this reason surgical measures should be resorted to.

### Varieties of Operation

I. **Dittel's Operation.**—This was formerly the classical procedure and was, until recently, generally performed.

Technic of Operation.—The patient is anesthetized and a sound introduced through the urethra into the bladder. A semilunar incision is made through the skin of the perineum, curving around the rectum in order to avoid wounding it. The incision is deepened by dissection until the capsule of the gland is reached and opened and the pus evacuated. The wound is packed and allowed to heal by granulation.

This operation gives free access to the prostate and permits the ready evacuation of the pus, but it has certain disadvanatges.

The wound is very extensive and takes a long time to heal, and from the proximity of the rectum below and the urethra above it is certain to be infected.

II. Another operation, suggested by Alexander, Fuller, and others, commends itself on the ground of simplicity, and also because the incision is in the line of the course which the pus takes when spontaneously evacuated.

Technic.—An external urethrotomy is done on a grooved staff, and the posterior urethra dilated with the finger. The collection of pus in the prostate is easily felt and the pus evacuated by tearing through the mucous membrane of the posterior urethra and opening up the abscess cavity with the right finger. The prostate should be held steadily by means of the left forefinger in the rectum.

The bladder is subsequently drained with a large soft-rubber catheter for several days.

The patient is allowed to get out of bed in a week, and at the end of the second week is able to pass all his urine through the urethra. If a pus collection is not found, Fuller advises a simple division of the prostate into two halves along the floor of the urethra and the bladder.

If pus forms later, it is thus afforded a means of escape and the bladder is drained for ten days with a tube.

III. Another procedure which is only applicable to those cases where operation has been delayed and the abscess is seen obviously pointing in the perineum, is, with the finger in the rectum as a guide, to thrust a narrow straight bistoury directly into the fluctuating mass, through the skin of the perineum, and evacuate the pus.

When spontaneous rupture of a prostatic abscess has occurred, and one or more fistulæ exist, they usually communciate with the bladder and are kept from healing by the urine flowing through them. These fistulous tracts can only be cured by preventing the leakage of urine by means of an external urethrotomy and bladder drainage, at the same time laying open, or at least curetting, the suppurating sinuses.

The above remarks apply particularly to the treatment of cases where a large area is involved in the suppurative process.

When a very **limited area of suppuration in the prostrate** is present, involving perhaps two or three of the prostatic tubules, the temperature is only slightly elevated and the local symptoms are not marked.

After two or three days the temperature becomes normal and the tenesmus and frequent urination disappear.

In such cases an incision into the prostate is not required, for the minute abscess generally ruptures into the urethra and the sinus fills in by granulation.

Wossidlo advises beginning regular massage of the prostate two or three times a week, followed by irrigation as soon as the abscess has discharged its contents into the urethra.

In this way it is possible to press out the pus, keeping the abscess cavity empty and allowing it to heal.

## CHRONIC PROSTATITIS

Chronic prostatitis is perhaps the most important complication of gonorrhea, for the reason that the gonococcus, with all its infectious qualities unimpaired, may be retained for years in the diseased tubular glands of the prostate without its presence being suspected.

Probably most of the cases where wives are infected with gonorrhea by their husbands come from an uncured prostatitis.

Chronic prostatitis is also of moment on account of the profound disturbance to the general nervous system, and impairment of the sexual function, which it usually occasions.

In almost every case of chronic gonorrheal urethritis the prostate is found to be involved.

Chronic prostatitis frequently originates as an attack of acute catarrhal prostatitis, which becomes chronic; or it may be the result of a slow, insidious extension through the prostatic ducts of an inflammation from the posterior urethra. In the latter case the posterior urethritis was not of necessity due to gonorrhea, but may have originated as a result of sexual excesses or abuses, such as masturbation, "withdrawal," etc.

The microorganism causing the inflammation in the prostate depends upon the exciting cause. The gonococcus is responsible for many cases, but in the nongonorrheal inflammations staphylococcus, streptococcus, colon bacillus, or active bacteria may be the infecting agent.

### Pathologic Anatomy

An opportunity has seldom been afforded for exact observations of the changes in chronic prostatitis. The findings in the few cases where autopsies have been made, notably by Fürbringer, are as follows:

GROSS APPEARANCES.—The prostate is slightly enlarged, the seat of a diffuse swelling, or enlarged in certain parts. The cut surface appears of a pale, dirty-brown color, softer and juicier than normal, and infiltrated with indurated bands of connective tissue of an ivory whiteness.

MICROSCOPIC APPEARANCES.—The *prostatic tubules* are stretched and changed into smaller or larger cystic cavities. Their walls are thickened from infiltration with round cells and swelling of the epithelium.

The *prostatic ducts* and *their mouths* are dilated and the seat of a round-celled infiltration, which stiffens them and keeps them open and gaping. The mouths of the ducts may be filled with small plugs of secretion, which are forced out by muscular contraction on urination, and appear floating in the urine as tadpole or comma-shaped bodies, under the name of *"Fürbringer's hooklets."*

In certain cases the mouths of the ducts are closed, so that the secretion does not run out.

The *cavities of the dilated tubules* are filled with a turbid, slimy fluid, composed of pus cells, desquamated epithelium, and altered prostatic fluid; and gonococci are harbored at this point for an indefinite number of years. All the tubules of the gland may be more or less affected, or the changes may be limited to a few scattered groups of tubules in one or both lobes.

The *intertubular fibromuscular stroma* is infiltrated with broad, tough, ivory-white bands of connective tissue.

## Symptoms

In many cases chronic prostatitis may exist without giving rise to any symptoms. Usually, however, a chronic posterior urethritis is present and the symptoms will be caused by both conditions. (See Chronic Posterior Urethritis.)

The symptoms have been grouped by Young and Geraghty,[1] in a study of 358 cases, under three heads: (*a*) sexual; (*b*) urinary; (*c*) referred.

The sexual function is usually disturbed, and the patient complains of premature ejaculation on coitus, or frequent nocturnal emissions. He notices, at least, diminished sexual force, and frequently imperfect or absent erections.

*Prostatorrhea* occurs in a moderate number of instances, but by no means constantly, and is present in perhaps 15 per cent of the cases, and is also a symptom of chronic posterior urethritis.

Prostatorrhea is the term given to the discharge, from the meatus, of a turbid, thick, sticky fluid of a brownish-yellow color, which generally occurs intermittently.

It is most frequent after stool and is then termed *defecation prostatorrhea:* and occurs more seldom at the end of urination, when it is spoken of as *micturition prostatorrhea.*

The discharge is accompanied by an unpleasant sensation in the deep urethra, and is followed by a feeling of weakness and exhaustion.

Prostatorrhea is due to the contractions of the muscles about the base of the bladder and rectum, pressing upon the prostate and squeezing out the contents of the prostatic tubules through their dilated and stiffened ducts. (See Chronic Posterior Urethritis.)

Prostatorrhea never occurs normally, and is important to differentiate from *other* urethral discharges.

The easiest of these to recognize is *urethrorrhœa ex libidine.*

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[1] Johns Hopkins Hospital Reports, vol. xiii, 1906.

This is the clear, transparent albuminous fluid emitted from every healthy urethra on sexual excitement and erection. The secretion is not derived from the prostate, but from Littré's glands and Morgagni's crypts in the urethra.

The discharge in *chronic gonorrhea* is purulent in appearance and contains numerous pus cells, epithelium, gonococci, and other microorganisms.

True *spermatorrhea* and *seminal emissions,* either sleeping or waking, are characterized by the presence of spermatozoa, while in prostatorrhea spermatozoa are absent.

In the cases of prostatitis caused by gonorrhea the character and quantity of the urethral discharge depend upon the stage of the urethritis. There may be a profuse purulent discharge, only a morning drop, or the urine may be perfectly clear. *Disturbances of urination* are generally present.

Urination is generally frequent, and the demand is urgent, and pain or burning during the act is often noted. Sometimes the urination is slow and difficult, and spasmodic stricture may exist, causing the retention of more or less residual urine in the bladder.

Examination of the urine shows a diversity of changes. In many cases *Fürbringer's hooks,* which are plugs of secretion formed in the mouths of the prostatic ducts, are squeezed out by the muscular contractions and appear in the second glass of urine.

The urine may be perfectly clear, but if an active urethritis is present it will appear turbid from pus. On examination the urine will often be found to contain albumin from interference with the blood circulation and a leakage of serum backward into the bladder. Cystitis is not infrequently a complication, and bacteriuria is often observed. Phosphaturia is not uncommon, especially in the patients suffering from sexual neurasthenia, and rarely at the end of urination or after massage of the prostate; a discharge of grayish white fluid consisting of lime salts mixed with mucus has been noted by Wossidlo and the author. *The referred symptoms* embrace a long category. Such patients complain of loss of energy, mental depression, and lack interest in all occupation or amusement. Their melancholy is so extreme that they sometimes have suicidal ideas, and are true sexual neurasthenics.

Pains are often referred to remote spots, and are felt in the suprapubic region, perineum, testicles, hips, buttocks, and elsewhere. Sometimes the pain simulates renal colic and the accompanying blood and pus in the urine may make a diagnosis difficult.

## Complications

Smaller or larger abscesses may form in the diseased prostate and communicate with the urethra. After they have discharged the pus, their cavities fill with urine at each act of urination, and slowly and incompletely void their contents.

The patient suffers all the inconveniences of partial urinary incontinence, and the stinking pus from the cavity flows out incessantly and involuntarily from the urethra.

The prostate may subsequently become changed into a large cavity in which sounds and catheters are apt to catch.

Another danger which threatens a patient with chronic prostatitis is *tuberculosis* of the genital organs.

Its development is favored by the factors which tend to lower the local resisting power.

These consequences only occur in neglected cases which have continued for a long time.

## Diagnosis

As the clinical history of chronic prostatitis, seminal vesiculitis, and chronic posterior urethritis is similar, we can only make a differential diagnosis by a careful examination of the patient.

The most important diagnostic measures consist in:

*I. Palpating the prostate per rectum.*

*II. The microscopic examination of the fluid which has been expressed from the prostate by digital pressure.*

On **palpation of the prostate,** the whole organ may be found enlarged and tender, or the right or left lateral lobe may be involved alone. If a few scattered tubules are affected, shot-like nodulations will be noticed, distributed irregularly over the surface. In the latter stages, with the formation of fibrous tissue in the intertubular substance, the prostate is only slightly enlarged, but *hard.*

To distinguish between prostatitis and seminal vesiculitis is at times difficult, even for one with experience.

The seminal vesicles are often involved at the same time, and the entire mass, made up of enlarged prostate and swollen vesicles, imbedded in a mass of infiltrate, may be easily mistaken for an uncomplicated prostatitis.

If no perivesicular infiltration is present, the *sharp outline of the upper margin of the prostate* can easily be felt.

If perivesiculitis has occurred and the lower part of the vesicles is imbedded in an inflammatory exudate, the *upper margin of the prostate can not be felt,* and the examining finger glides over the upper border and along the posterior surface of the vesicles without perceiving the furrow indicating the line of demarcation between the prostate and vesicles.

On palpation of the prostate, it is found that the secretion is more easily expressed than in the normal condition, and in this way we can obtain the material for the **microscopic examination of the prostatic fluid.**

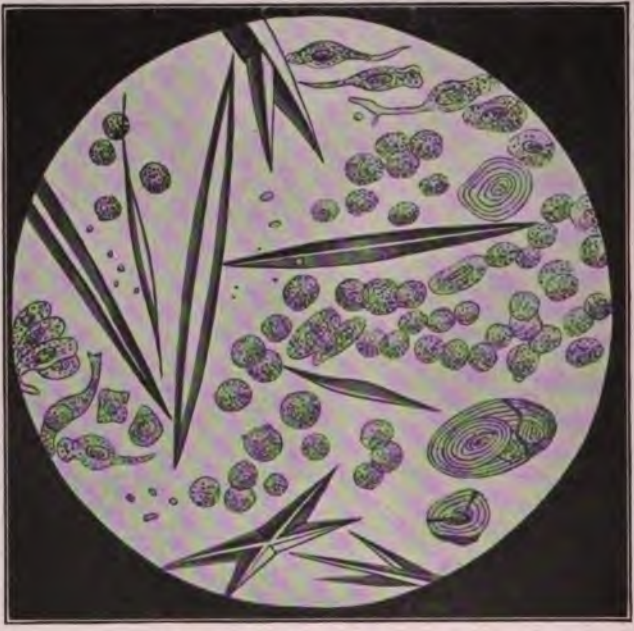

Fig. 109.—Diagrammatic representation of prostatic secretion. Böttcher's crystals, amyloid bodies, pus cells, and epithelium from prostatic ducts.

This is obtained by massaging the prostate through the rectum and collecting the secretion on a glass slide as it drips from the meatus.

Instead of using a slide the **expression-urine test** may be employed by massaging the prostate through the rectum and so expressing or forcing out the contents of the prostatic tubules through their ducts into the urethra. The patient then urinates into a glass, and the stream of urine washes out the expressed prostatic contents into the glass.

On inspection, after massaging a normal prostate, the urine is seen to be milky, from admixture with prostatic fluid.

If the prostate is diseased, flakes, chunks, and masses, formed of caked and thickened prostatic secretions, are generally noted, but sometimes the expression-urine only appears turbid from mixture with pus. Fürbringer's hooks from the prostatic glands are often present. By inspection alone of the secretion, whether it be collected on a slide or by the expression-urine test, we can not form a correct opinion as to the healthy or diseased condition of the prostate, and it is necessary to resort to examination with the microscope.

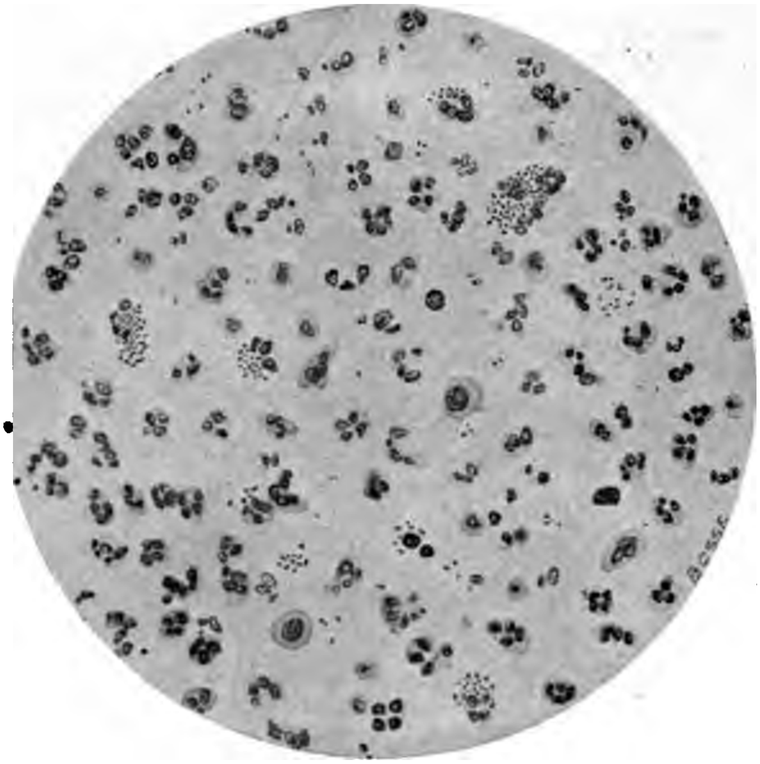

Fig. 110. -Secretion from chronic gonorrheal prostatitis, containing pus cells and gonococci, extra- and intra- cellular. Original drawing from microscopic specimen.

## Microscopic Examination

If the prostate is the seat of acute or chronic inflammation, the microscope shows PUS CELLS in greater or less numbers, and often **gonococci**. If no pus is present, prostatitis can be excluded.

In active cases pus cells are very numerous, but as the patient improves the pus cells diminish in number, many mononuclear cells make their appearance, and the lecithin bodies return.

In cases with much pus, gonococci are frequently, but not invariably, found even after several examinations, although they are present and growing in the deeper follicles of the prostate.

Because the gonococci are not found it by no means implies that they are not present, and for that reason a case of prostatitis can never be considered cured if any considerable number of pus cells are present in the expressed secretion.

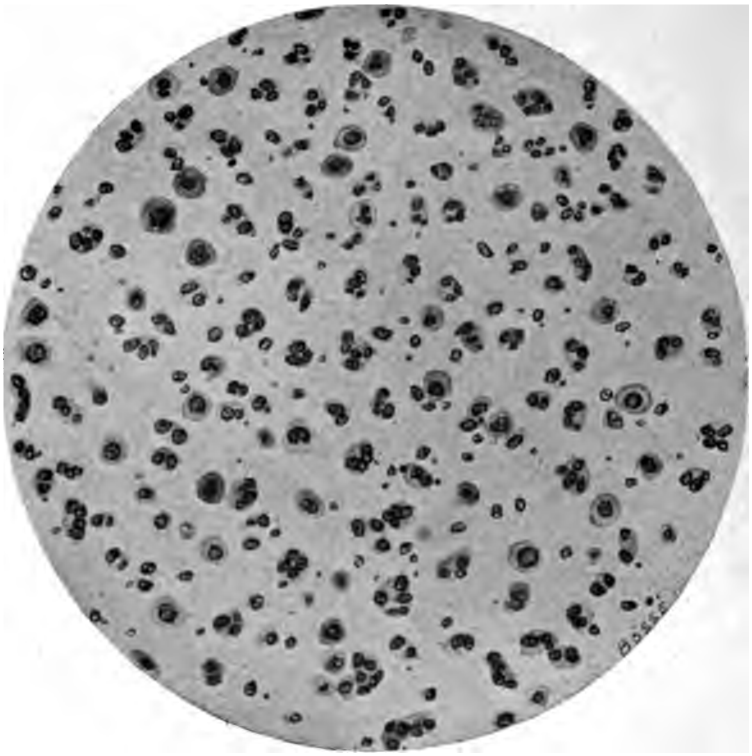

Fig. 111.—Secretion from chronic gonorrheal prostatitis. Large amount of pus; many mononuclear cells; no organisms. Original drawing from microscopic specimen.

The normal prostatic fluid is found to contain many elements on microscopic examination. The findings are:

I. *Lecithin bodies,* which are the most striking element in normal prostatic fluid. They are very numerous and appear as small, round, refractile bodies, and are chemically a glycerophosphate of neurin.

They are only found in prostatic secretion which is fairly free from pus, and one of the signs of restitution to health is a reappearance of the lecithin bodies.

II. *Mucus and granular phosphates,* with certain crystals, either *oxalate of lime, triple phosphates,* or *crystalline calcium phosphate.* If the urine is received immediately after being passed, the granular phosphates may be in the form of casts or clumps, but if it has stood for some time these break up and the phosphates are scattered throughout the urine.

III. *Epithelium* from the bladder, glands, and ducts of the prostate.

IV. *Amyloid Bodies.*—Authorities differ as to the frequency with which these are seen. They are generally absent in young and middle-aged subjects, but occur more frequently in elderly men. When present they are seen to have a concentric arrangement and are formed from the secretion of the prostatic cells and broken-down cells. Later they may become calcified and form prostatic concretions.

V. *Phosphatic concretions* are occasionally found, and in older subjects large hyaline cylinders, which are due to the inflammatory exudation which takes place in the gland tubules.

Many of the above findings are also present in seminal vesiculitis, but one element is absolutely characteristic of the prostatic secretion, as it is found nowhere else, and that is—

VI. *Böttcher's Crystals.*—These crystals are formed by adding a drop of 1 per cent ammonium phosphate solution to the secretion expressed from the prostate.

The crystals are distinguished by their dagger shape and the beautiful forms which they assume upon crystallization, and their base is found nowhere but in the prostatic fluid. In order to find them it is necessary to examine the prostatic secretion without mixture with urine, as the urine interferes with the crystallization.

The unmixed prostatic fluid can be obtained by collecting on a cover-glass some of the fluid which escapes from the meatus after massage of the prostate.

VII. *Spermatozoa.*—These are not found in cases of uncomplicated chronic prostatitis, but, as it is almost impossible to massage the prostate without at the same time expressing some of the contents of the vesicles spermatozoa are generally found.

VIII. If the prostate is the seat of acute or chronic inflammation, *pus cells* are always found, and from a clinical standpoint the pus cells are the important elements to look for, as, if no pus is present, prostatitis is at once excluded.

In considering the question of marriage for an individual who has had prostatitis, the permission should not be given *if pus is present,* even though no gonococci may be found.

For while gonococci are easily found in the expressed pus when abundant, a few may still exist in the prostatic tubes, with all their infectious qualities, which may be overlooked on microscopic examination.

On examining a case of chronic prostatitis with **the urethroscope** a chronic inflammation of the posterior urethra is found to be nearly always present.

The mucous membrane of the posterior urethra is purplish red, swollen, and congested. The colliculus is greatly enlarged, so that it stands up at the end of the endoscopic tube like a half-ball and bleeds freely.

## Bacteriology of the Prostatic Secretion

The point of supreme importance, however, in the matter of permitting marriage or coitus is whether the inflammation in the prostate was caused by the gonococcus, and whether it is still present, or whether the infectious agent was some other organism.

There is a great diversity in the reports of the different investigators, depending upon the length of time after infection when the examinations were made.

It is certainly a fact that in some cases the gonococcus may disappear spontaneously after some months, but an infection with other organisms, staphylococcus, streptococcus, or colon bacillus, occurs to prolong the inflammation. Von Notthaft, after examining 120 patients, found gonococci in the prostatic secretion as follows: 73 per cent in the second half-year after infection; 50 per cent in the third half-year; 18 per cent in the fourth half-year, and 6 per cent in the third year. From the end of the third year gonococci were no longer to be found, while in the second half-year other organisms made their appearance.

De Santos Saxe[1] examined 108 cases of prostatitis and found 28.7 per cent of gonococci in the prostatic secretion. After three years gonococci were found rarely, even after most persistent efforts. Mixed infection occurred in 86 per cent of the cases studied; the older the case, the more prevalent was the mixed infection. Staphylococci occurred in 74 per cent, bacilli in 28 per cent, Gram-positive diplococci in 10 per cent, and streptococci in 7.6 per cent, of cases with mixed infection.

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[1] New York Med. Jour., Oct. 2, 1909.

Wolbarst[1] reports several cases in which the gonococci persisted for more than three years: ten years in one case and eighteen years in another.

### Cultures

On account of the difficulty of finding the gonococcus microscopically several years after infection attempts have been made to cultivate the organisms from the prostatic secretion. By this means other organisms can be readily cultivated and identified, but the gonococcus oftentimes will not grow, even when hydrocele agar, which is the favorite medium, is used, and this is especially true of the cases of long standing; so that for a practical test as to their presence a negative culture does not necessarily mean the absence of gonococci.

### Provocative Instillations

After several examinations of the expressed prostatic secretion without finding gonococci, an instillation of nitrate of silver, gr. v to the ounce, into the posterior urethra, followed in twenty-four hours by prostatic massage, will often bring out the gonococci so that they can be found microscopically.

### Prognosis

The prognosis of chronic prostatitis is on the whole not unfavorable, but improvement is slow and treatment must be continued for a long time. The mental symptoms are often materially improved after a short time, under treatment, and the progress of the case toward recovery can be controlled by palpation of the prostate and microscopic examination of the secretion.

**Relapses** are apt to occur, from a lighting up of a catarrhal inflammation, and must be treated by suspending all local treatment by massage and relying on irrigations of nitrate of silver in the urethra.

### Treatment

It is important, in the treatment of these cases, to secure the confidence of the patient and encourage him by explaining that his condition is one which can be cured, and that he is not impotent nor likely to become so, and that the mental disturbances of which he complains are due to a purely local condition which is not dangerous. At the same time he should be informed that the treatment calls for great patience on the part of both physician and patient and may extend over several months.

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[1] Med. Rec., Aug. 21, 1909.

The first indication for treatment is to improve the general condition of the patient by means of diet and exercise in the open air.

Constipation is generally a prominent symptom, and it is necessary to regulate the bowels, using saline cathartics for their depleting action on the pelvic organs, which has some effect in relieving the congestion of the prostate.

All sorts of erotic excitement should be strongly interdicted on account of their effect in inducing congestion of the prostate. Coitus should not be permitted because of the danger of infecting the woman.

Under the head of local treatment we can speak of measures which have a more direct action upon the prostate.

The most useful means of affecting the prostate itself is **massage through the rectum,** and we can in this way express the contents of the tubular glands.

The advantage comes from periodically emptying the dilated prostatic tubules of their retained and thickened secretion. There is also an improvement in the blood circulation, which causes absorption of the inflammatory products and strengthens the relaxed muscular fibers.[1]

The massage should be performed twice or three times a week.

In order to lessen the danger of epididymitis Frank advises irrigating the urethra and filling the bladder before massaging the prostate. After the massage the patient empties the bladder.

In this way the urethra is cleansed first, and any infectious material which may have been expressed from the prostatic tubules is washed away afterward.

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[1] The author has often noted that in certain cases, on beginning the treatment by massage, there would be no immediate improvement.

After massaging a number of times, the prostate, which was originally *hard*, begins to feel soft, and at each massage a larger amount of pus was expressed than on beginning treatment.

When softening and increased discharge once begin, the enlargement of the prostate disappears with great rapidity, sometimes in one week.

The probable explanation is that the ducts of the dilated tubules are closed, and that the massage forces out the plug, and also presses out the accumulation of pus in the dilated tubule, and the prostate collapses after being emptied.

In other cases a dram of prostatic fluid mixed with pus may be expressed at the first massage, and the quantity diminishes at subsequent sittings till only a few drops are squeezed out.

These patients often require only a few applications of the massage before they are entirely cured.

It is supposed that the massage causes an alternate opening and shutting of the mouths of the ejaculatory ducts, which exert a suction, and cause material in the urethra to be drawn into them, descend through the vas deferens, and cause epididymitis.

Since adopting this suggestion in his office and clinic, epididymitis following prostatic massage is a rare accident in the author's practice.

The solutions used before massaging the prostate are albargin, 1:1000, if gonococci are present; oxycyanide of mercury, 1:4000, or nitrate of silver, 1:4000, if there are no gonococci.

Not all patients are suited to massage of the prostate, and, as long as irritative symptoms such as nocturnal emissions and painful erections are present, the massage is apt to be badly borne.

The question as to how long to continue the massage is a very important one, for it sometimes happens that by continuing it too long the neurasthenia is made worse. As a practical rule it may be stated that the massage may be continued as long as the symptoms are improving and the pus in the prostatic secretion is growing less, but after six or eight weeks' continuous treatment the improvement ceases and the case is at a standstill.

At this point it is better to stop all treatment for one month. Not infrequently after a month's rest the pus will be found to have disappeared. If pus is still present, another course of massage is indicated, but in a few cases it is impossible to rid the prostate entirely of pus.

In those cases, Albarran, Young, and Zuckerkandl have performed perineal prostatectomy, but there is always the danger of impotence or sterility to be considered after such an operation.

Before resorting to such a serious and doubtful procedure the patient should be advised to try the effects of a long vacation spent out of doors; a couple of months camping in the woods or at sea will relieve the neurasthenia, and the *vis medicatrix naturæ* will most likely clear up the prostatic suppuration.

As an adjuvant to the massage, heat in the rectum applied by means of *Arzberg's rectal psychrophore* is always useful. The instrument is inserted in the rectum and lies against the prostate, and a continuous stream of hot water is allowed to flow through it once a day.

The prolonged application of heat in all chronic inflammations improves the circulation and causes the absorption of inflammatory products. We use it as a routine method of treatment in all cases of chronic prostatitis in addition to massage and intravesical irrigations and vaccines.

In some obstinate cases the *gonococcus vaccine* injected subcutaneously has seemed to exert a beneficial effect.

As most cases of prostatitis suffer from **chronic posterior urethritis,** it is important not to overlook this condition, but to treat it as well.

If there is a great deal of catarrhal inflammation, with much pus formation, irrigations are in order; but if the suppuration is only slight, *instillations* with an Ultzmann syringe are indicated.

In light cases 5 or 10 grains to the ounce of nitrate of silver may be used, but in old and obstinate cases stronger solutions are called for, and the strength may be gradually increased to 25 grains to the ounce.

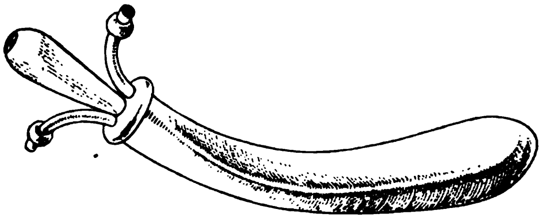

Fig. 112.- Arzberg's rectal psychrophore.

Strong solutions can be better applied through the **endoscope.**

In nearly every case of chronic prostatitis the verumontanum is markedly diseased and requires particular attention.

The best method of treating it is to apply a strong solution of nitrate of silver, 100 grains to the ounce, directly upon it through the urethroscope.

Some reaction follows these applications, the discharge increases, and the patient has frequent urination, often followed by bleeding.

After eight or ten days it is safe to make another application.

Tincture of iodine may be used if the nitrate of silver causes too much pain.

After half a dozen strong applications, the verumontanum will be found to be in the normal condition again; but if the chronic posterior urethritis accompanying the prostatitis has existed long, a submucous infiltration will have occurred, which also demands treatment by **dilatations with the Kollmann-Frank irrigating posterior dilator.**

The indication for beginning dilatations, as stated by Frank, is after the massage has been continued for some time and the prostate feels normal, but the patient still has symptoms of neurasthenia, and the microscope shows a small amount of pus in the expressed prostatic secretion.

After the local conditions in the prostate and posterior urethra have been cured, the neurasthenia generally disappears. When, however, it persists, *faradism*, with one pole in the urethra and the other in the rectum, is often beneficial. (See Posterior Urethritis.)

## BIBLIOGRAPHY

Bierhoff, Fred: Gonorrheal Prostatitis, Centralbl. f. d. Krankh. d. Harn-u. Sex.-Org., May 31, 1906.
Frank, E. R. W.: Gonorrhea of the Prostate, Med. News, 1902.
Saxe, de Santos: Sago Bodies, New York Med. Jour., 1907.
Wolbarst, A. L.: New York Med. Jour., Jan. 23, 1915.

# CHAPTER XIX

## DISEASES OF THE SEMINAL VESICLES

## ACUTE SEMINAL VESICULITIS

Acute inflammations of the seminal vesicles are generally due to gonorrhea, although a chronic inflammation may originate from other causes.

A gonorrheal inflammation of the interior of the cavity of the vesicle is excited when the gonococci pass from the posterior urethra through the ejaculatory ducts, and are deposited within the vesicle.

Its walls secrete pus and its cavity soon becomes filled up and distended with a purulent accumulation.

### Symptoms

The symptoms are not very characteristic, and are merely those of the posterior urethritis, which, of course, is always present. Fever and a throbbing pain in the vesicles and tenderness in the suprapubic region are always observed.

*Seminal discharges* which are *red* or *chocolate colored* from the admixture with blood often occur. The blood may be derived from the cavity of the vesicle itself or may be acquired by the semen, from a congested posterior urethra, as it passes through it.

If the posterior urethritis is cured, the urine is clear at first, but later in the disease the vesicles pour out their purulent contents into the posterior urethra, and the pus flows back into the bladder, discoloring the urine when it is passed.

The ejaculatory ducts may be occluded by the inflammatory swelling in which case the pus, carrying organisms, can not escape but is forced back into the epididymis, giving rise to an acute epididymitis.

### Diagnosis

The diagnosis of seminal vesiculitis can only be made by *rectal examination,* and the vesicles can be felt swollen, soft, fluctuating, and intensely tender.

Epididymitis is a most frequent result of vesiculitis, and is

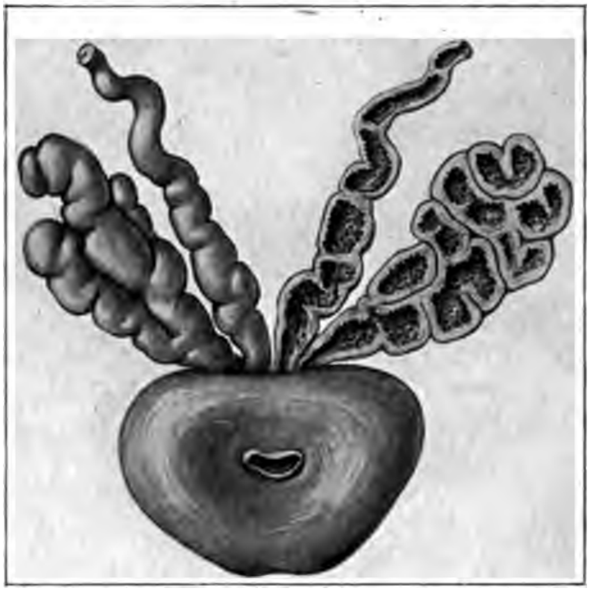

Fig. 113.—Prostate and seminal vesicles. Left vesicle laid open to show structure.

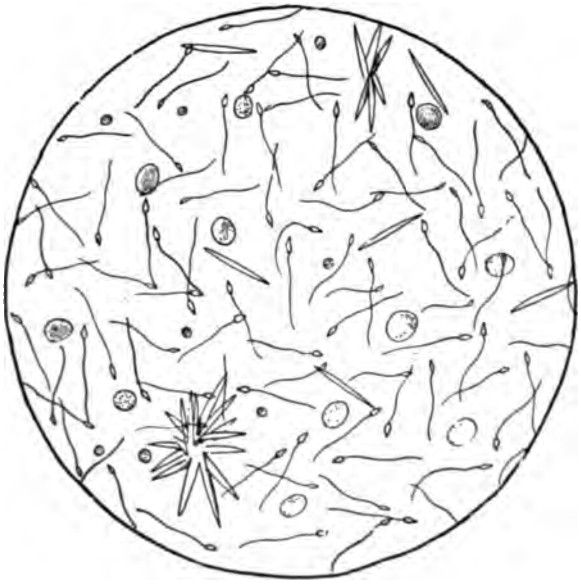

Fig. 114.—Microscopic examination of material expressed from seminal vesicles and prostate, showing spermatozoa, pus cells, and Böttcher's crystals.

brought about by some of the gonococci-laden pus cells being carried through the vas deferens and deposited in the epididymis.

Peritonitis, which sometimes becomes general, may occur from the close relation which the peritoneum bears to the vesicles.

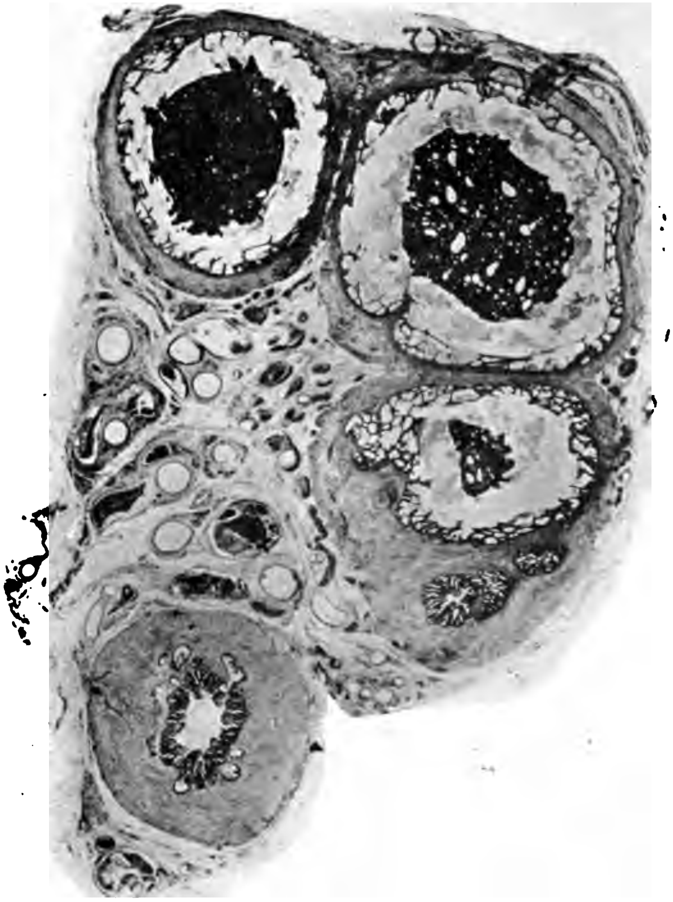

Fig. 115.—Ampulla of vas and seminal vesicle. Low power.

## Treatment

The treatment of acute vesiculitis is chiefly expectant, and consists in putting the patient to bed and giving a saline cathartic, which is always in order in every pelvic inflammation.

Hot sitz-baths and copious irrigations of the rectum with hot water are useful in allaying the inflammation.

If the posterior urethritis is severe, sandalwood oil relieves the tenesmus and renders the urine less irritating.

Injections into the anterior urethra, of course, are contraindicated, but above all things any attempt at massage or stripping the vesicles should be absolutely interdicted.

Under this plan of treatment most cases of acute vesiculitis will get well in from two to four weeks' time; but when resolution does not occur the disease passes into the chronic state.

## CHRONIC SEMINAL VESICULITIS

The condition of chronic inflammation of the seminal vesicles was but little understood until the publication of Eugene Fuller's first paper upon this subject in 1893. Chronic vesiculitis may originate from an *acute* attack of vesiculitis which does not undergo resolution; but, as a rule, it develops insidiously, as the result of the extension of a chronic inflammatory process which begins in the posterior urethra and extends through the ejaculatory duct. The ejaculatory duct as a rule is not compressed by the changes, but throughout the whole course of the disease it remains patulous, and where it remains patulous sterility does not occur. On the other hand closure of the duct sometimes occcurs and the purulent secretion is dammed back within the vesicle without an opportunity for drainage, thus converting the cavity of the vesicle into a pus pocket.

Absorption from this focus takes place, in this way accounting for many previously obscure cases of toxemia and joint affections.

According to the classification devised by Fuller, chronic seminal vesiculitis presents itself in *two varieties:*

I. **Atonic vesiculitis,** in which there is only an atony of the muscular fibers composing the walls of the vesicle.

II. **Inflammatory vesiculitis,** in which the walls of the vesicles are thickened and indurated as a result of inflammation, which may be simple, gonorrheal, or tubercular in origin.

Either form of vesiculitis may exist by itself; but, as a rule, there is a combination of atony and inflammation of the vesicular walls.

### Atonic Vesiculitis

This form of vesiculitis may be induced by a previous attack of acute inflammation in the organ, which does not undergo complete resolution. It is more liable, however, to be provoked by some form of sexual abuse, which consists in a frequent repetition of the sexual act. In consequence the muscular fibers become exhausted, lose their tone, and the walls of the vesicles become thinned, atonied, and stretched. The cavities become distended with seminal fluid, because the weakened muscular fibers are no longer able to evacuate the contents, and the secretion becomes thick and inspissated.

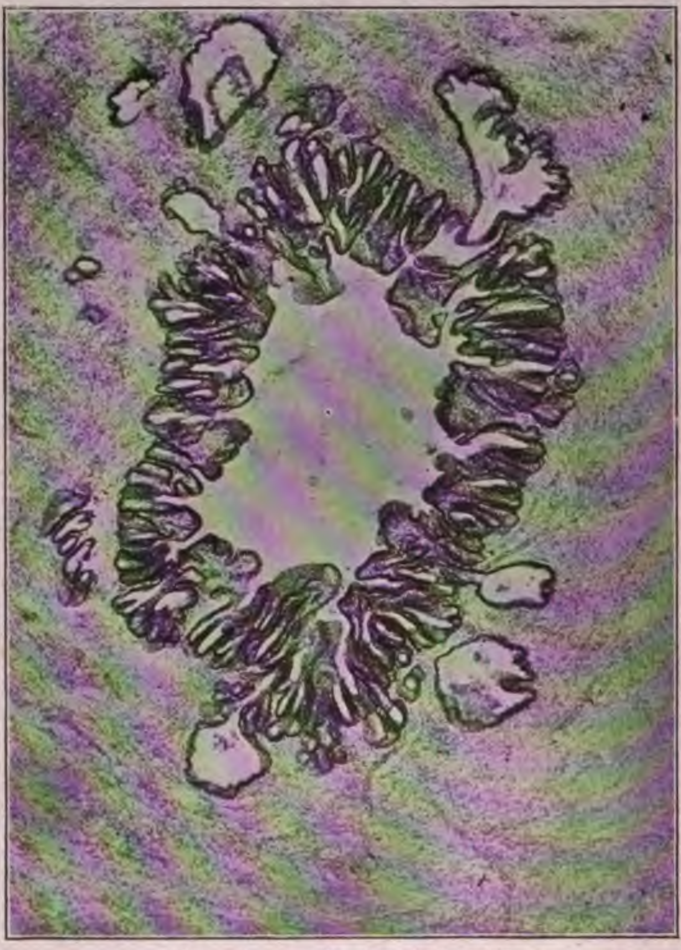

Fig. 116.—Ampulla of seminal vesicle.

The vesicles are distended and enlarged, and feel like a swollen leech to the examining finger.

On stripping the vesicles the expressed seminal fluid appears abnormal.

The *expression-urine* is not clear or slightly milky in color as it should be, but the expressed contents of the vesicles appear in the glass of urine as *coagulated masses* of *gelatinous material,* which often resemble casts half an inch long and as thick as a knitting needle. These masses are the jellified contents of the vesicle, molded by the ejaculatory ducts as they are squeezed through them. Microscopically they are found to consist of a sort of thickened wall identical with the rest of the body itself, in which are imbedded innumerable spermatozoa. The bodies also contain epithelium from the vesicles, and in cases of disease of the vesicles pus cells with or without gonococci.

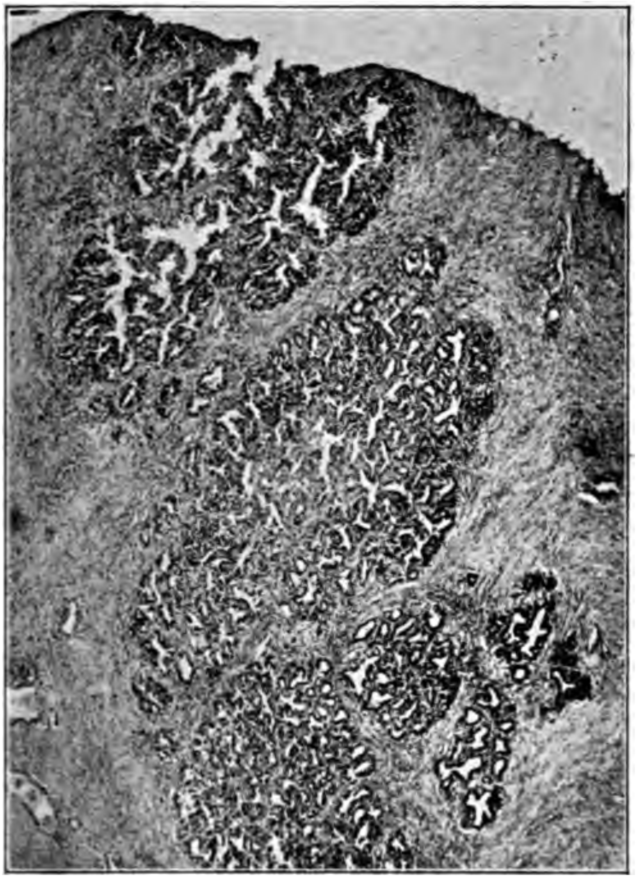

Fig. 117.—Cross section of normal seminal vesicle.

The other form in which the inspissated semen is found resembles sago-like globules floating in the urine from the size of a barleycorn to a lentil. Under the microscope these are found to be composed of an albuminous material containing large numbers of spermatozoa.

Smaller bodies, resembling melting sugar or frogs' spawn, averaging the size of a pinhead, are often present in considerable numbers, disappearing soon after being passed in the urine. Microscopically they are structureless, consisting only of a homogeneous matrix.

In addition to these, delicate, yellowish-white, skin-like fragments are often found, which are probably composed of bits of inspissated secretion which has lain a long time in the vesicles, perhaps between the closely lying folds of a collapsed portion.

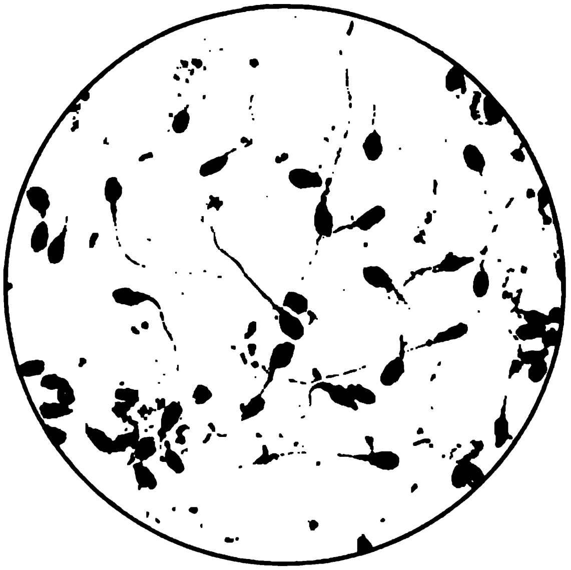

Fig. 118. Spermatozoa obtained by massaging healthy seminal vesicles.

The above findings do not denote a diseased condition, but only a hypersecretion and a certain physiological amount of stagnation of secretion due partly to retention, and partly to the absorption of the fluid portion of the vesicular contents (De Santos Saxe).

After a time the atonic vesicle almost invariably becomes infected by some germ, often the bacillus coli from the rectum, and inflammatory changes are induced.

For practical purposes it is only necessary to consider two forms of chronic inflammation of the vesicle:

(*a*) **Chronic inflammation without perivesiculitis.**

(*b*) **Chronic inflammation with perivesiculitis.**

When *perivesiculitis is absent,* there is no inflammatory infiltration or hyperplasia of the connective tissue surrounding the vesicles. The vesicle is large, and its walls are thinned and atonied, but they are hardened and sclerosed by fibrous changes, as a result of the inflammation which always occurs in this form within the walls.

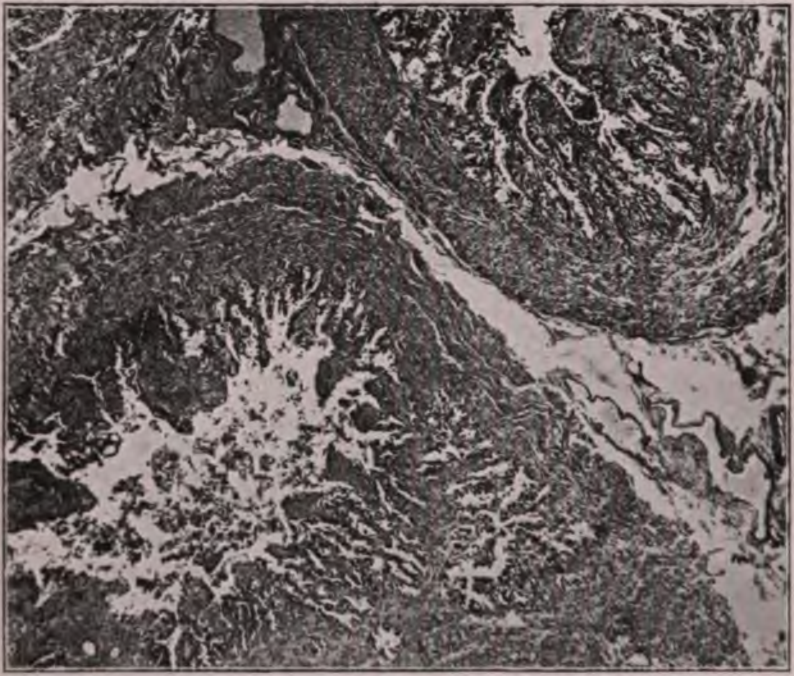

Fig. 119.—Purulent spermatocystitis.

A mucopurulent secretion may be abundant and accumulate within the cavity of the vesicle. Granulations often form within the cavity, causing hemorrhage.

The entire vesicle may be filled with a blood clot, or, if the bleeding is slight, the seminal discharge may be stained brown or chocolate color.

When *perivesiculitis is present,* a small round-celled infiltration is thrown out in the early stages, surrounding and imbedding the vesicles. In time the infiltration becomes organized with fibrous connective tissue, which forms adhesions, binding the vesicles down to the base of the bladder. The entire mass, composed of vesicles imbedded in fibrous tissue, appears like a part of the prostate, and may easily be mistaken for it, on rectal examination.

After the fibrous tissue has existed for a little time, it begins to contract and in consequence the vesicles are pressed upon and squeezed together so that they become smaller than normal.

The ejaculatory duct is never compressed by these changes, but always remains open; consequently there is no sterility.

## Etiology

As to the etiology of the inflammatory forms of vesiculitis, gonorrheal infection is a very frequent cause.

Chronic vesiculitis may originate from an *acute* attack of vesiculitis; but it is more frequently due to a *gonorrheal* inflammation of the posterior urethra, which extends along the ejaculatory duct and attacks the walls of the vesicle and often the perivesicular connective tissue.

Although the gonococcus is responsible for many cases of vesiculitis these organisms die out after a time and are replaced by staphylococci, streptococi and colon bacilli.

Other causes besides gonorrhea may induce chronic inflammatory changes in and around the vesical walls.

A *nonspecific vesiculitis,* so called to distinguish it from the gonorrheal, or specific, form, may arise *within* the cavity of the vesicle itself, as a result of an atonic condition of the vesicle.

Again, a low grade of chronic inflammation of the **posterior** urethra may be established as a result of sexual excesses, masturbation, etc., which spreads along the ejaculatory duct and attacks the vesical wall.

Finally, with old men who are beginning catheter life the traumatism often excites a subacute inflammation of the vesicles, which extends to the epididymis.

## Symptoms

The symptoms of vesiculitis are obscure and often referred to remote organs and yet they present a rather typical clinical picture to one accustomed to seeing such cases. Belfield has classified them as follows:

*Urinary.*—There may be frequent and painful urination or retention of urine and the urine may contain pus or blood.

*Genital.*—Another important group of symptoms is connected with the *sexual function*. In the early stages there is an increase in the sexual desire, with frequent nocturnal emissions and premature ejaculation on coitus. The seminal discharges are often mixed with blood, which may be acquired from the posterior urethra or the cavity of the vesicles. As the case progresses, erections cease, the sexual desire is lost, and at last a condition of true impotence is established. On straining at stool a glairy, sticky discharge escapes from the meatus, which is the secretion expressed from the dilated and patulous ejaculatory ducts and is termed *spermatorrhea.*

Patients with vesiculitis often give a history of gonorrhea, which lasting for months or years, is apparently cured for a time, but an exacerbation occurs on the slightest provocation, and a reinoculation of the urethral mucous membrane takes place from the escape of gonococci from the interior of the seminal vesicles.

The *mental symptoms* are always very prominent, and the individual suffers from depression of spirits, and melancholy, irritability of temper, and quarrelsomeness. Hypochondria is notably marked, and patients are alarmed over ridiculous trifles. They complain of the penis being shriveled, cold, or numb; that the testicles are retracted or that one hangs lower than the other, and suppose that the testicles are beginning to atrophy and they are growing impotent. In their alarm they consult some of the advertising quacks, who prey upon their fears and deluded ignorance.

*Rectal Symptoms.*—Pain is often referred to the rectum and may be accompanied by a local proctitis causing the patient to consult a rectal specialist.

*Arthritic Symptoms.*—In many cases of chronic rheumatism with a history of gonorrheal infection, an examination of the vesicles and their contents will disclose these organs as the focus of infection, from which the organisms responsible for the joint inflammation are constantly being absorbed by the blood and carried to the affected point. In the same way many obscure toxemias may be traced to the absorption of toxins from a chronic suppuration within the vesicles.

*Abdominal Symptoms.*—The pain may be referred to the region of the appendix, the ureter, or the kidney, and operations are reported for a supposed disease of the appendix, ureteral calculus or gallstones, in which the real difficulty was later found to be the vesicles and the pain was reflexly referred to the abdominal contents.

## Diagnosis

From the foregoing account it is evident that a diagnosis can not be made except by careful examination and exclusion, and all obscure toxemias, chronic joint affections, and functional neuroses should have the condition of the seminal vesicles carefully investigated, as well as those patients who give distinct histories of prolonged gonorrheas with frequent exacerbations on slight provocation and the decided sexual neurasthenics.

The diagnosis can only be made by **rectal examination,** and in order to determine the condition of the vesicles a very considerable amount of practice is necessary in order to attain the necessary *tactus eruditus.* As the vesicles and prostate are continuous, without a line of demarcation, when perivesiculitis is present, it is difficult for the beginner to differentiate them, and, until one is experienced, a diagnosis of enlargement of the prostate is generally made, when the vesicles alone are enlarged and the prostate is normal in size.

TECHNIC OF EXAMINATION.—The patient, with his bladder moderately distended with urine, assumes the "leap-frog" attitude, bending over a chair and grasping the sides with his hands. The surgeon makes counterpressure with one fist doubled up, pressing against the bladder, and the index finger of the other hand is inserted into the rectum. In order to get well up beyond the upper margin of the vesicle, it is sometimes necessary for the surgeon to support his right foot on a chair and by means of his knee make strong pressure against the elbow of his examining hand, in order to drive it well in.

If the vesicles are normal they feel soft, and the amount of distention depends on circumstances. If *atonic vesiculitis* is present, they feel large, distended, tense, and very painful. If *perivesiculitis* exists, they are hard, indurated, and brawny, feeling like a piece of pork, on account of the infiltration through the connective tissue, which surrounds the vesicles and forms adhesions which bind them down upon the bladder.

After examining the condition of the vesicles their contents should be stripped or expressed by the examining finger, beginning at the upper margin and squeezing or stroking in a downward direction, so as to press out the contents through the ejaculatory duct. The quantity of expressed material which runs out at the meatus varies from a few drops to half a dram or more. On examination the material is found to be thick and jellied or purulent.

The fluid expressed should be always examined microscopically. On examination with the microscope, *normal semen*, which is a mixed secretion from the prostate and vesicles, is found to be composed of large and small finely granular testicle-cells, some columnar and squamous epithelium, a few large, round hyaline bodies, lecithin corpuscles, amyloid bodies, a few leucocytes, spermatic crystals, and spermatozoa. In chronic seminal vesiculitis, *pus* is added to these findings and the spermatozoa are entirely absent or diminished in number, and either dead or of a very slight degree of motility.

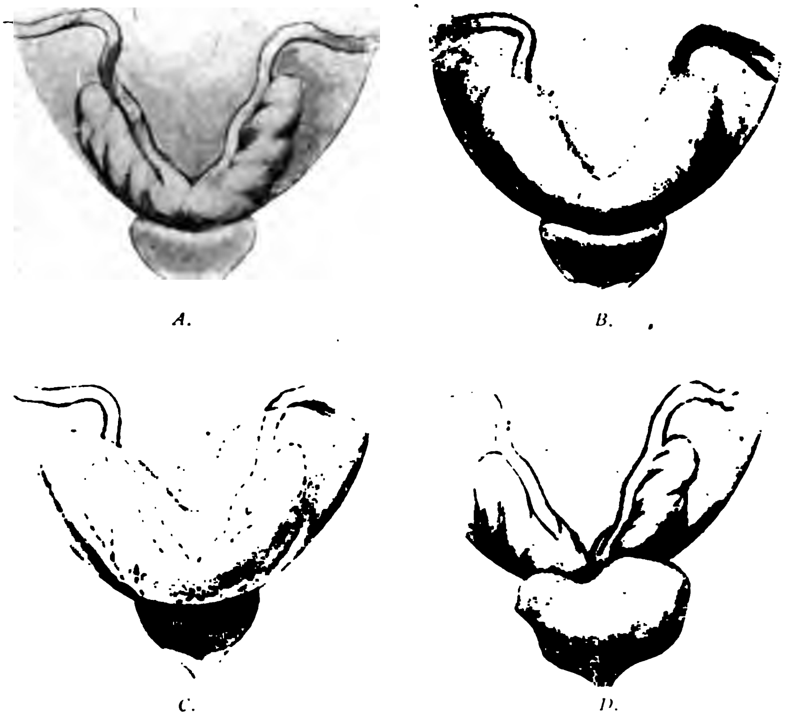

**Fig. 120.** —*A*. Normal seminal vesicles and prostate. *B*. Chronic seminal vesiculitis without perivesicular infiltration—no involvement of prostate. *C*. Chronic seminal vesiculitis with perivesicular infiltration. Outline of vesicles indicated by dotted lines. White area surrounding them composed of infiltration. Prostate not affected. *D*. Prostate irregularly enlarged from chronic prostatitis. No involvement of vesicles.

As the patient's condition improves the spermatozoa reappear and also regain life and motility.

## Treatment

The treatment consists in massaging or expressing the contents of the vesicles twice a week. The effects of stripping are to empty the vesicles of their inspissated contents, without forcing the muscular fibers to contract, and eject the semen, and through the rest thus afforded them the muscles recover their tone. The inflammatory thickening around the vesicle is absorbed as a result of the massage.

Contraindications to stripping are: (*a*) the existence of an acute attack of vesiculitis; (*b*) blood in the expressed material, or (*c*) excessive tenderness. With these conditions present there is always danger of setting up an epididymitis.

The posterior urethra should not be overlooked, but should receive appropriate treatment, with irrigations or instillations or by the endoscope. It is desirable, however, not to use local treatment to the posterior urethra and strip the vesicles at the same sitting, but to allow a couple of days to intervene. The duration of treatment is protracted, requiring from two to twelve months to effect a cure; but since Fuller's work upon the subject it is possible to cure cases which were beyond the reach of treatment before.

In the obstinate cases characterized by marked sexual neurasthenia or intractable gonorrheal rheumatism, Fuller advises free incision into and drainage of the seminal vesicles, and Belfield advises a simple incision into the vas which provides drainage of the vesicles in a simple manner and without the long convalescence necessitated by the extensive operation devised by Fuller.

**Seminal Vesiculotomy.**[1]—Fuller reports 224 cases operated upon without a death, and with relief of symptoms in 95 per cent of the cases. He states that there is no loss of sexual power subsequently.

With the patient in the knee-chest position, two longitudinal cuts through the skin and fascia are made, opening up the ischiorectal fossæ. These are joined by a transverse incision just in front of the rectum.

With the left finger in the rectum as a guide, the rectal wall is separated from the prostate and vesicles by blunt dissection with the finger-tip of the other hand.

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[1] Med. News, March 26, 1904; Jour. Am. Med. Assn., May 4, 1901; Med. Rec., Oct. 30, 1909.

After the separation is made a long grooved director is thrust through the tissues into the apex of the vesicle, using the finger in rectum as a guide for the proper direction.

A scalpel is passed along the grooved director and the vesicle laid open for half an inch; the incision in the vesicle is then divulsed, with the finger-tip opening up widely the cavity of the sac.

The left vesicle is then opened in the same way. If granulations are found in the cavities they are curetted and packed with gauze and a rubber drainage tube placed between the gauze packing and the rectal wall on either side and the wound closed with sutures.

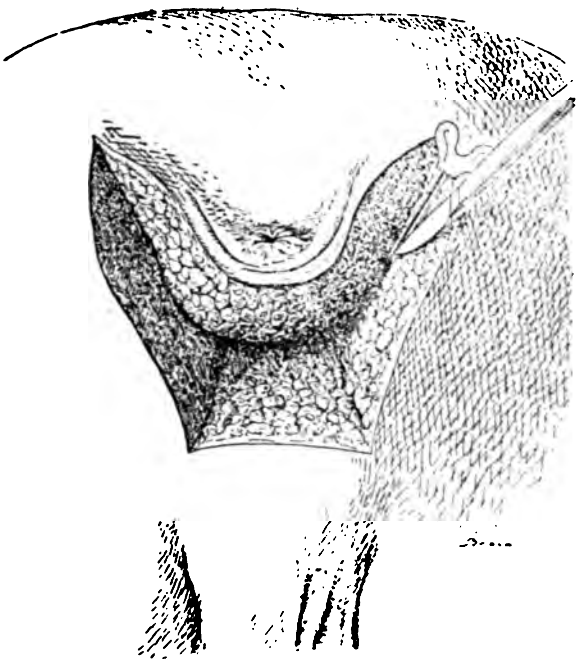

Fig. 121.—Showing the point of the director maintained at the apex of the right seminal vesicle, while the scalpel is passing along the groove preparatory to incising the organ.

In the after-treatment no irrigation with the tubes is used; the gauze is removed on the fifth day and the drainage tubes on the ninth.

The bowels should be moved daily to guard against distention of the rectum with feces, and the patient kept in bed for two weeks.

The object of the operation is to provide free drainage for the cavities of the vesicles which are distended with pus, and so stop the absorption of toxins into the blood.

The same object is attained by a different technic by J. Bentley Squier.[1]

With the patient in the extreme lithotomy position, a semilunar incision is made across the perineum. The recto-urethralis muscle is divided, and by blunt dissection, the vesicles are brought into view. At the point Squier advises passing a needle threaded with heavy silk through the tissue at the junction of the prostate and bladder on either side; by pulling these sutures downward and forward, the floor of the bladder with the vesicles covered by the fascia are brought into view. The fascia over the vesicles is then incised and punctures or incisions into the vesicles are made. A drainage tube of small caliber is placed in the vesicle and held in place by being sewed with catgut to the fascia. The perineal wound is thus closed by sutures and the drain removed after ten or fifteen days.

**Vasostomy.**—On account of the intractable character of chronic vesiculitis and the fact that a certain number of cases were not relieved by massaging the vesicle, Belfield suggested and practiced draining and medicating vas ampulla and vesicle through an incision in the vas.[2]

Belfield describes his technic as follows:

"Two features are important (1) fixation of the vas, which may otherwise drop into the scrotum and be recaptured with difficulty; (2) pulling the vas through the skin cut above the skin for manipulation; (3) exploration of vas for obstruction by sounding with a silkworm thread."

After the usual cleansing and cocainizing, the cord is caught by a vulsellum forceps whose points do not quite meet and hence do not pierce the subscrotal structures; the cord is caught an inch lower by a second vulsellum. The cord between the vulsella is supported by the left forefinger while a half-inch cut is made down to the sheath of the vas. This is carefully opened, the vas pulled out and its canal opened longitudinally; a thread or wire may be passed into the vas for exploration if desired. A blunt needle attached to a small syringe is introduced into the vas and the solution slowly injected; two or three drams often distend the vesicle uncomfortably. The finger in the rectum can press some of the vesicular contents into the urethra, permitting the injection of more solution into the vas. A catgut or other thread, passed into the lumen of the vas upward for a quarter-inch and then out through its wall and tied loosely above the skin, serves, if subsequent injections are necessary, to keep the vas open, to pull the vas out of the skin-cut, and to guide the needle into its lumen. If complete transverse division of the vas is deemed necessary, the silkworm or catgut thread is passed into the lumen and out through the wall of each cut end, and the thread ends tied loosely above the skin. When reunion of the cut ends is desired, this thread loop is tightened, the thread serving as an axis splint which secures exact apposition of the cut ends of the vas. This principle, first published by Mayo (*Annals of Surgery*, Jan., 1895) supersedes all other methods of reuniting the divided vas. It has been noted that a vas of which a half-inch has been resected can spontaneously reunite with a patulous lumen; evidently because the two ends are kept in the same axis by the sheath of the vas and are brought together by the shortening of the scrotum through the contractions of the dartos, which usually follow a wound of the scrotum. This is important to remember in performing vasostomy.

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[1] Boston Med. and Surg. Jour., June 11, 1940; Cleveland Med. Jour., Dec., 1913; New York Med. Jour., Feb. 20, 1915.

[2] Jour. Am. Med. Assn., April 22, 1905; ibid., Dec. 25, 1909.

"The vas can be opened through either anterior or posterior wall of the scrotum; though each has its advantages, the latter seems preferable, the patient lying in the semiprone position.

"The slight operation can be done in the office under novocaine injected hypodermically.

"The solutions used for injecting the vas are in general collargal in from 3 to 5 per cent solutions."

After the injection is made the collargol can be demonstrated in the vas by means of a radiogram (Thomas).

VALUE OF VASOSTOMY.—By this trivial operation, the entire seminal duct is relieved of abnormal tension, vas and vesicle are drained and medicated, the epididymis is protected from infection or, if already infected, from pressure infection; it has sometimes seemed that the pus drained from the epididymis also. Medication of the vesicle is effective because the injected solution remains in its cavity for hours or days. When preliminary cleansing is desired, a slow stream can be injected through the vas to the vesicle and milked into the urethra by the finger in the rectum (demonstrated with argyrol solution).

As to the value of the various methods of treatment above mentioned, it would seem desirable to begin with massage of the vesicles which is enough to cure most cases. When this is found to be unavailing, vasostomy may be tried and as a last resort, the operation cf vesiculotomy applied to the intractable cases.

## TUBERCULOUS VESICULITIS

The seminal vesicles are usually involved by an infiltration with tuberculous nodules during the progress of a case of genitourinary tuberculosis.

The infection may extend from tuberculous deposits in the posterior urethra or prostate or may result in consequence of an extension of the disease from the epididymis along the vas deferens.

It is supposed that the involvement of the vesicles in the majority of cases is *secondary,* although J. W. White has noted that the vesicles often show evidences of infection weeks or months before the tuberculous process is evident in the corresponding epididymis.

A chronic or subacute inflammation of the vesicle, either gonorrheal or simple, is a strong predisposing element in allowing the tuberculous process to become ingrafted upon these organs.

Uncomplicated tuberculous disease of the vesicles is never acute except in the presence of a mixed infection, either with the gonococcus or staphylococcus.

In this case an acute suppurative inflammation takes place within the cavity of the vesicle, which becomes filled and distended with pus.

Uncomplicated tuberculosis begins insidiously, and has a notable tendency to invade the surrounding tissues, and the process often becomes quiescent, although liable to take on renewed activity upon slight provocation.

A few cases, however, result in breaking down of the tuberculous nodules, with the formation of a perivesicular abscess, which discharges either through the rectum or perineum, leaving a fistula.

The symptoms of tuberculosis of the vesicle are not marked, and this condition exists unsuspected until a rectal examination is made, disclosing hard nodules in the walls and perivesicular connective tissue.

As both vesicles are infiltrated and thickened as well as the connective tissue around them, the mass is continuous with the prostate, and it is no easy task to distinguish these structures apart. In advanced cases the prostate is almost always the seat of tuberculous deposits as well.

### Treatment

The treatment consists in hygienic measures alone, of which the most important is an outdoor life in a suitable climate. Codliver oil and creosote are the drugs most in vogue.

Operative treatment is, in general, not required in acute suppurative inflammation caused by a mixed infection, when the accumulation of pus takes place *within* the cavity of the vesicle, as the pus drains out into the urethra, through the ejaculatory duct.

When, however, the *perivesicular* tissue infiltrated with tuberculous nodules breaks down and forms an abscess, it is necessary to evacuate the pus. This may be accomplished through a free incision in the perineum, or, as Fuller and Routier prefer, by thrusting a director into the tumefaction, through the rectum, and divulsing the tissues until an opening large enough to admit the finger is obtained.

Extirpation of the vesicle has been attempted a few times for tuberculosis, but the results are far from satisfactory.

From the inaccessible location of the vesicles, an extensive incision is required to reach them, and the hemorrhage is difficult to control.

The bladder walls and prostate are generally affected, and it is difficult or impossible to remove all the diseased material. The wound is slow in healing, and the confinement to bed exerts a bad influence upon the general condition of the patient; so that the tuberculous deposits, which are usually present elsewhere, advance in consequence.

The epididymis is involved in practically all these cases and the present view is that the operative procedures should only remove the tuberculous epididymis by epididymectomy without any surgical interference directed towards the vesicles themselves.

## BIBLIOGRAPHY

Belfield, W. M. T.: Jour. Am. Med. Assn., Dec. 25, 1909; Trans. Am. Urol. Assn., 1909.
Fuller, Eugene: Jour. Cut. and Genitourinary, Sept., 1896; Med. Rec., May 21, 1904; ibid., Oct. 30, 1909; ibid., Jan. 27, 1912.
Herbst, Robert H.: Jour. Am. Med. Assn., Dec. 21, 1912.
Schmidt, Louis E.: Jour. Am. Med. Assn., Jan. 15, 1916.
Squier, J. Bentley: Cleveland Med. Jour., Dec., 1913; New York Med. Jour., Feb. 20, 1915; Boston Med. and Surg. Jour., 1914.

# CHAPTER XX

# STRICTURE OF THE URETHRA

## SPASMODIC STRICTURE

Spasmodic stricture is a pure functional disturbance, without organic change, consisting in a spasm or cramp-like contraction of the cut-off muscle surrounding the membranous urethra.

### Causes

(*a*) *Located in the posterior urethra.* An abnormal irritability from excess in coitus or masturbation.

(*b*) *Located in the anterior urethra.* A granular patch or stricture. The introduction of a foreign body, such as a sound or bulbous bougie, or a piece of calculus, formed in the bladder and making its way through the urethra, and finally the reflex irritation caused by a narrow meatus.

(*c*) *Point of irritation not in the urethra, but remote from it,* as an operation about the anus, fissures or fistula of the anus, and entozoa in the rectum.

(*d*) *Various psychical influences,* such as shame or embarrassment.

The influence of these various points of irritation is carried through the nervous system and causes, as a reflex, a contraction of the cut-off muscle.

## ORGANIC STRICTURE

### Definition

A deposit of newly formed fibrous connective tissues lying underneath the mucous membrane of the urethra and interfering with its dilatability. This fibrous tissue has a tendency to contract and produce a narrowing of the urethral caliber.

### Etiology

(*a*) *Inflammation,* which is generally due to gonorrhea, occasions an infiltration of small round cells which, if not absorbed, becomes organized into connective tissue.

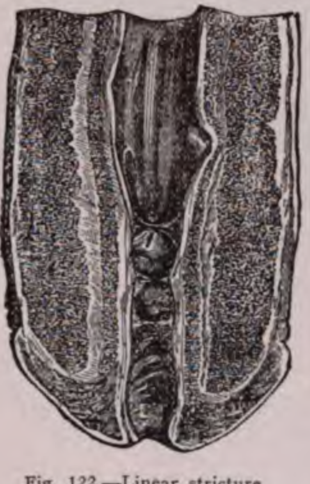

Fig. 122.—Linear stricture.

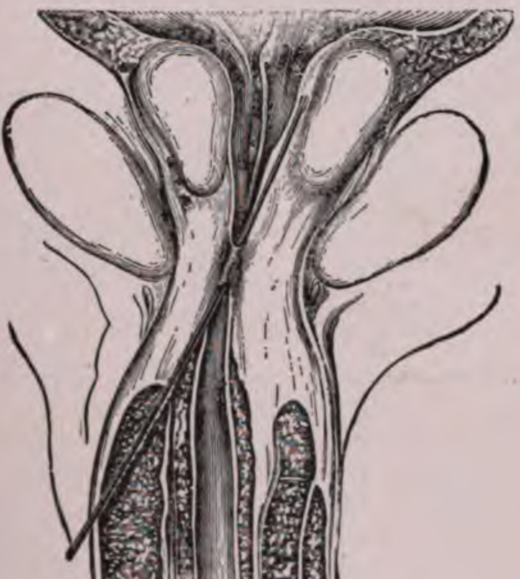

Fig. 123.—Annular stricture.

(*b*) *Traumatism.*—A laceration or rupture of the urethra is healed by the process of cellular infiltration, which is thrown out to a considerable extent and subsequently becomes organized into connective tissue. Traumatic strictures are always notably dense and tough.

## Pathology

In gonorrhea, particularly the chronic form, the mucous membrane of the urethra becomes the seat of an infiltration with small round cells, which extends into the submucous connective tissue and finally involves the spongy tissue of the corpus cavernosum.

If the infiltration is *absorbed*, stricture does not form; but if absorption does not take place the infiltrating small round cells become transformed into *spindle cells*, and these are ultimately converted into dense, retracting connective tissue (scar tissue). The transformation goes on slowly, and it requires at least one or two years before the soft infiltration has become organized.

The following changes in the tissues result from the contraction of the new fibrous tissue:

Morgagni's crypts and Littré's glands of the urethra, which were surrounded by the periglandular infiltration, have been obliterated by the contraction of the fibrous tissue.

If the corpus spongiosum was involved, its meshes are obliterated in the same way.

The caliber of the urethra is narrowed by the presence of a mass of firm, bloodless scar tissue, composed of fibrillated connective-tissue cells lying underneath the mucous membrane and covered with many layers of squamous epithelial cells.

*Desquamation* of these squamous epithelial cells continues for years, forming light filaments, which float in the urine.

## Varieties of Organic Stricture

I. **Soft or recent stricture** is merely an infiltration of the tissues with inflammatory products, composed chiefly of small round cells.

II. **Cicatricial or inodular stricture** is a mass of new fibrous tissue which has been formed by the transformation of the soft infiltration into true contractile connective tissue, and which, as it becomes older, grows tougher, denser, and more inelastic.

A stricture is described as *linear* when it consists of a fine band of fibers, *annular* when it is composed of a broader band encircling the urethra, and *tortuous* when it is made up of a heavy, irregular mass of tissue, producing a great deal of distortion and narrowing of the urethral canal.

## Number

Traumatic Stricture is always *single*, and occurs at the point of rupture in the canal.

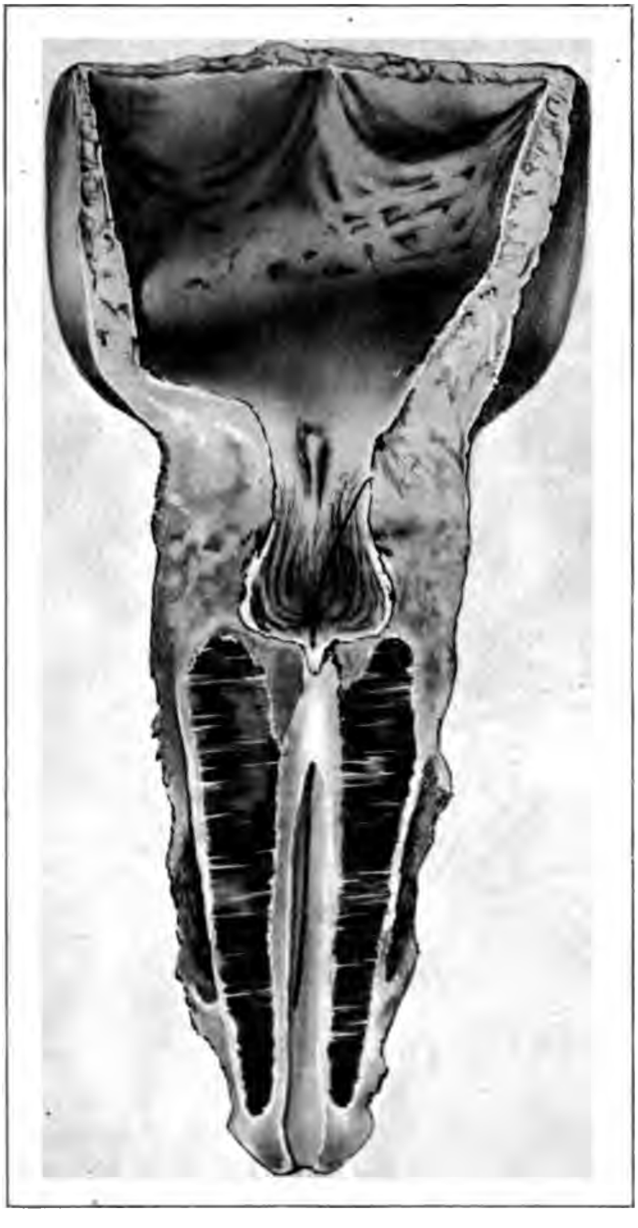

Fig. 124. Heavy stricture of urethra and dilated pouch behind it. Hypertrophied bladder

Gonorrheal strictures are apt to be *multiple,* and it is usual to have two or even three present at the same time.

## Location

Sir Henry Thompson examined 320 anatomic preparations of stricture and found that in 215 cases the bulbomembranous region was strictured and in 105 cases the stricture was in the first five inches of the canal.

The prostatic urethra is *never* strictured except as a result of traumatism, as inflammation here only produces a simple condensation and hardening of the submucous tissues, but does not narrow the caliber of the canal.

## Changes Which Take Place Behind the Stricture

As a result of the obstruction to the free outflow of the urine, the urethra becomes enlarged and pouch-like, and a loss of its elasticity follows, from the frequent stretching which accompanies each act of urination.

This pouch retains a drop or two of urine, which decomposes, irritates the mucous membrane, and causes a chronic inflammation, with a gleety discharge.

The softened mucous membrane sometimes **ulcerates.** When a *small* ulceration occurs, a few drops of urine escape into the tissues and occasion a small abscess, which opens externally, forming a **urethral fistula,** or the urine may gain access to the tissues through the crypts and follicles which become dilated.

If a *large* ulceration takes place, a considerable quantity of urine escapes into the loose cellular tissue, and **extravasation** of **urine** results.

## Changes in Bladder and Kidneys

The increased effort on the part of the bladder to overcome the resistance offered by the stricture causes a **hypertrophy of the bladder-wall.** The muscular bundles project into the cavity of the bladder and diminish its capacity, and contraction of the cavity occurs.

In exceptional cases the walls become thinned and atrophied, and *vesical atony* results.

### Residual Urine

**Definition.**—*The urine which remains in the bladder after the patient has endeavored to evacuate it completely.*

Residual urine exists in 93 per cent of cases of stricture, and increases as the age of the patient advances. It results in cystitis, with vesical atony and damming back of the urine upon the kidneys.

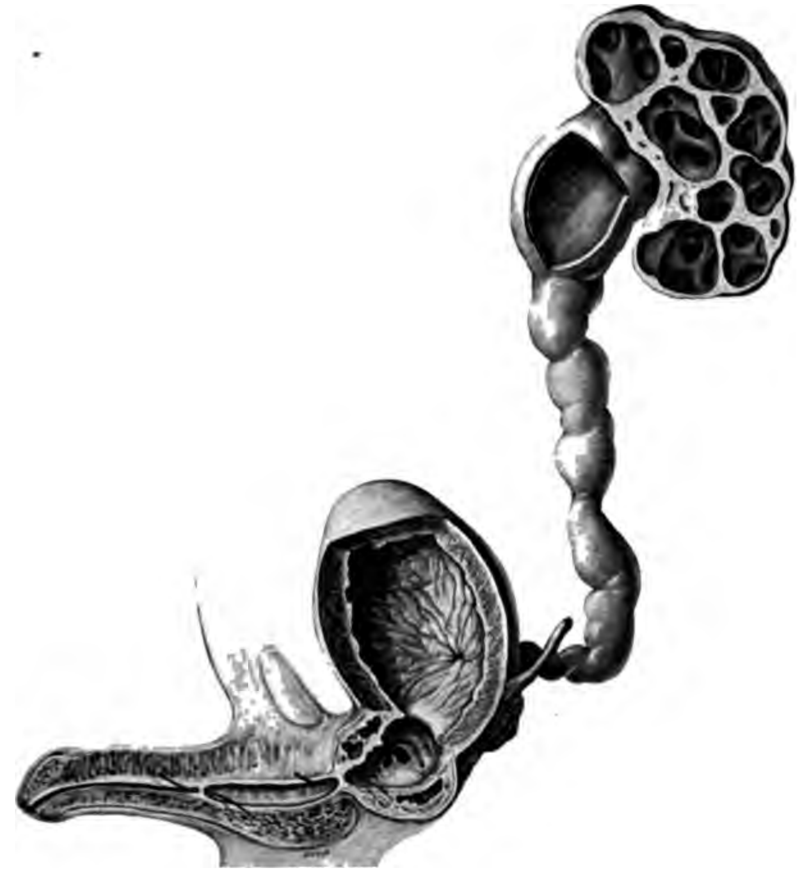

Fig. 125.—Changes behind a stricture. Dilatation of pouch behind the strictures. Hypertrophy and contraction of bladder. Dilatation of ureter and kidney. Hydronephrosis.

The **ureters** and **kidneys** become distended and dilated from the backward pressure of the urine, as a result of the muscular contractions of the bladder during urination.

The medullary tissue of the kidneys is atrophied, and sac-like dilatations form (hydronephrosis). Pyelitis and abscess of the kidney occur as a result of infection with bacteria conveyed upward from the decomposing residual urine.

### Symptoms

(*a*) **Frequent urination,** in the early stages depending upon a congestion of the posterior urethra and exaggerated irritability. Later in the course of the case, cystitis causes the desire to urinate frequently, and after the bladder has become atonied and full of residual urine the dribbling and incontinence, or overdistention, take place.

(*b*) **Dribbling after urination** results from some drops of urine, which are caught in the pouch behind the stricture, escaping a few minutes later.

(*c*) **Distorted or Smaller Stream.**—The patient requires a longer time to pass his water, and the stream is twisted or split.

(*d*). **Gleety discharge from the meatus,** composed of mucopus and shreds in the urine, is occasioned by the catarrhal inflammation of the mucous membrane *behind* the stricture, from the irritation of the decomposing urine.

(*e*) **Retention of urine** occurs at times suddenly and early from acute congestion of the mucous membrane at the strictured point, and is apt to be excited by exposure to cold or wet and alcoholic or sexual excesses.

Later in the progress of the case the retention is caused by the direct obstruction of the outflow of urine, arising from the slowly contracting stricture.

(*f*) **Pain in the urethra** is neuralgic in character and inconstant, and may never be felt.

(*g*) **Interference with Coitus.**—The erections are generally feeble, and premature ejaculation occurs from congestion and irritability of the posterior urethra, or the semen may be retained behind the stricture until the engorgement of erection subsides, when it oozes from the meatus.

### Diagnosis

The examination of the urethra, as a rule, is not very painful, but in nervous individuals it may be injected with a 4 per cent solution of novocaine.

For purposes of diagnosis the **steel sound** is too inexact, since, without disclosing any details, it will merely demonstrate that an obstruction exists in the urethra which prevents the sound from entering the bladder.

By means of the **flexible bulbous bougie** it is possible to feel the slightest pathologic changes in the canal. As the bulb is introduced it glides along the urethra for six inches, until it fetches up against the cut-off muscle, and as it passes through the membranous urethra it is grasped by the muscle, but it feels freely movable again as soon as the posterior urethra is gained. When it reaches the sphincter of the bladder it is slightly grasped again, but slips by and moves freely in the cavity of the bladder.

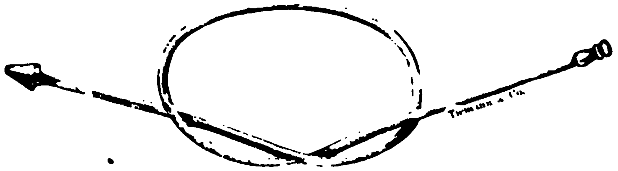

Fig. 126. Flexible bougie à boule.

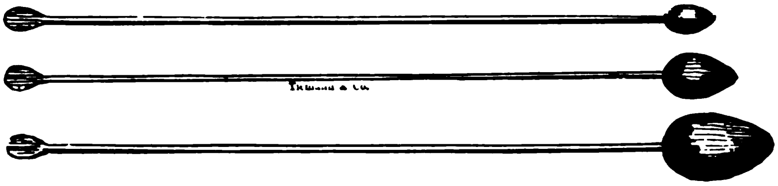

Fig. 127. Metal bougies à boule.

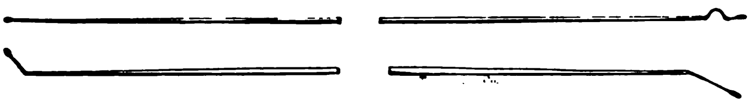

Fig. 128. Filiform whalebone guides.

The same sensations of resistance and grasping are felt on withdrawing the bulb, and we should guard against the error of mistaking the resistance of the cut-off muscle for a stricture in the deep urethra.

As the bulb is moved the *healthy* mucous membrane of the urethra feels soft and velvety, but, when a stricture is impinged upon, a sensation of jolting is felt. There is a perceptible roughness of the walls of the urethra, or one or more fine bands, like fiddle-strings, may be discovered. These changes are more easily felt upon the *withdrawal* of the bulb.

The **metal bulb** is less useful than the flexible bougie, as its smooth, polished surface glides over the roughnesses of the surface without being held by them.

**The Otis urethrometer** is chiefly used in measuring the *caliber* and determining the dilatability of the urethra. It has the advantage that it can be introduced through a narrow meatus and expanded *behind* the stricture, and we are enabled to measure its caliber with accuracy.

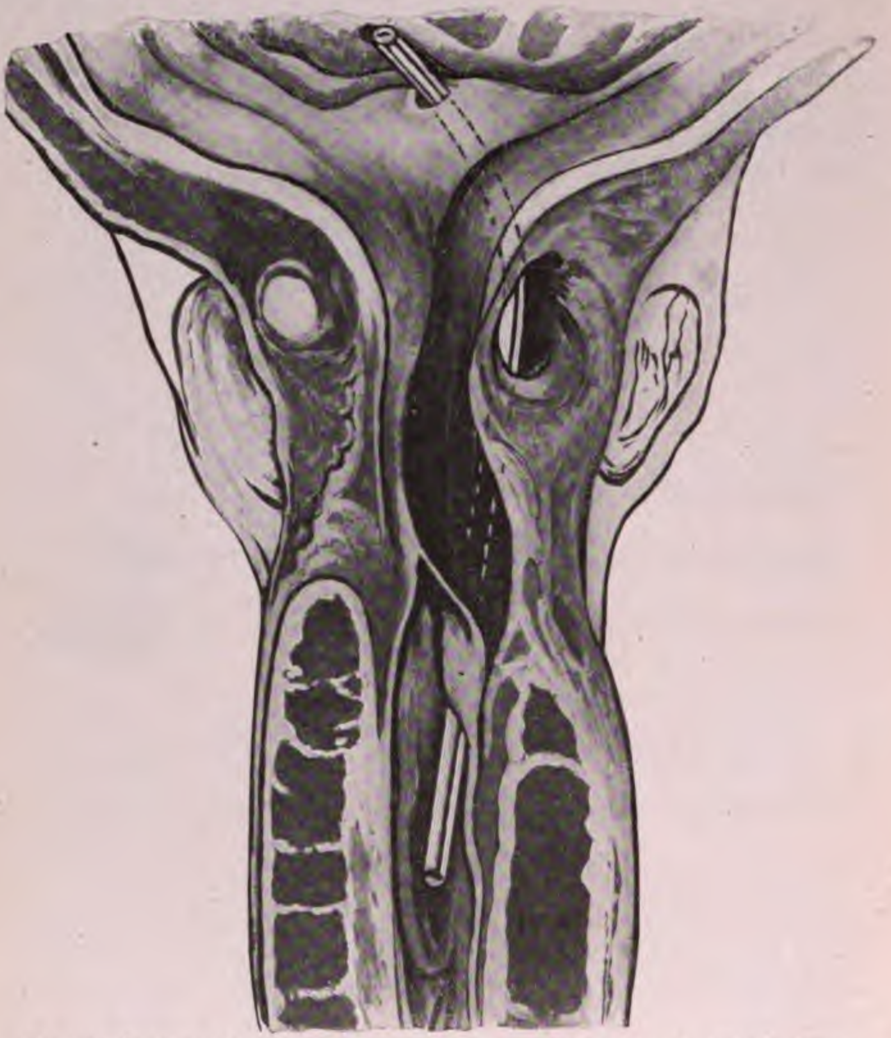

Fig. 129.—Stricture of the bulbomembranous urethra and false passage. The instrument has been forced through the tissues into the bladder.

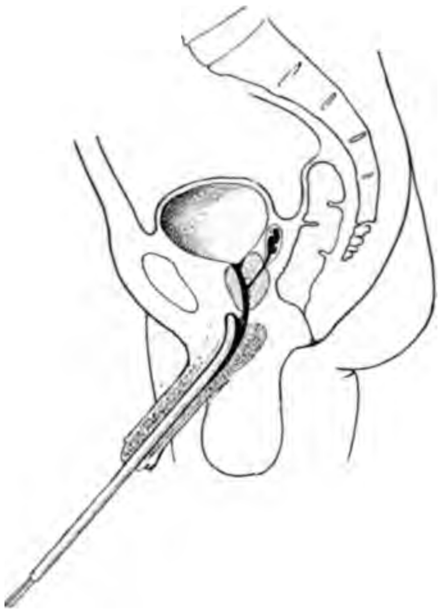

Fig. 130.—Sound perforating anterior wall of urethra at bulbomembranous junction.

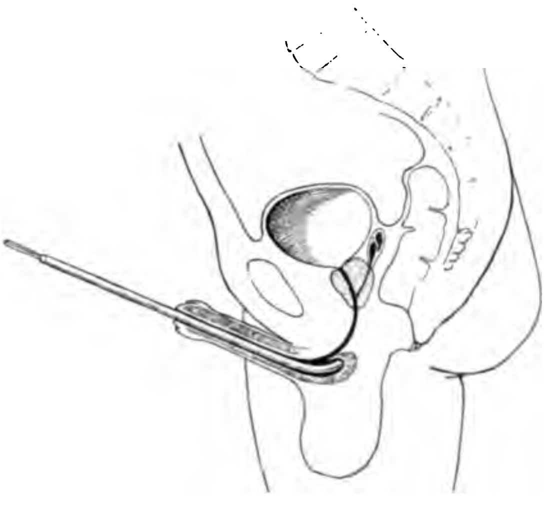

Fig. 131.—False passage. End of sound perforating urethra at bulbomembranous junction and wounding bulb of corpus spongiosum.

In the case of very tight strictures, in which the caliber is too small to allow the passage of the smallest bulbous bougie, we have recourse to **whalebone filiform guides.**

As long as urine flows out past a stricture we can not speak of it as impassable, although the difficulty of entering it may be great on account of its fine, narrow lumen or because the opening is not central, but lying off to one side.

In order to find the opening it may be necessary to pass six or eight guides down upon the face of the stricture, and, with an assistant holding them firmly in place, try by twisting and manipulating successively one after another to find the opening through the stricture.

It is always desirable to inject ʒij of olive oil into the urethra, to lubricate the canal and distend the narrow opening through the stricture.

Another manipulation, which sometimes succeeds, is to pass a sound down upon the face of the stricture, and hold it pressed firmly against it for ten to twenty minutes. In this way a certain amount of dilatation is often accomplished, and a funnel-shaped depression in the stricture is formed, with the opening at the bottom, instead of being located off to one side, as before.

In not a few instances the opening through the stricture can be discovered by visual inspection through an endoscope.

If great difficulty has been experienced in introducing a guide through a stricture, it is better not to withdraw it and take the chances of getting it in again, but tie it in, and leave it, either for the purpose of continuous dilatation or for operation.

## Treatment

All strictures, no matter where they are located, *if soft* and *recent*, are best treated by **gradual dilatation.** After the small round-celled infiltration has become converted into fibrillated connective tissue and is dense and contracted, dilatation no longer meets with the success which would have attended its use in the earlier stages. Even in these old cases, however, we can in many instances enlarge the caliber of the stricture and maintain it subsequently, by means of an occasional passage of a sound, at a size which does not obstruct the urinary outflow. On this account it is always well, in nearly every case, to try the effects of dilatation before proceeding to the more heroic measures of operation.

In private practice, where patients are more regardful of their health, and seek medical advice early, the larger proportion of strictures are amenable to treatment by dilatation. In hospital practice, on the other hand, patients are careless and neglect themselves, and when they do apply for treatment the stricture is apt to be so extensive and so firm and dense that operation is the only resource.

For purposes of dilatation we have recourse to:

(*a*) Flexible bougies.

(*b*) Steel sounds, with the curve recommended by Van Buren.

(*c*) Kollmann's dilator.

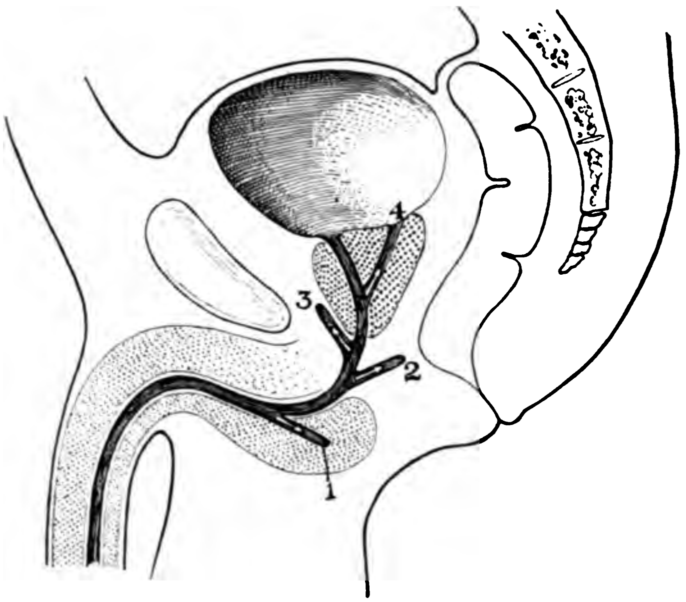

Fig. 132.—Various directions which false passages may take. *1.* Into bulb. *2* and *3.* Into tissues in front and behind. *4.* Through prostate into bladder.

Unlike the operative treatment, we may consider both regions of the urethra together in discussing the treatment by dilatation.

In the case of a stricture, particularly if located in the bulb or membranous urethra, which is **below No. 16 French in caliber,** we should always begin dilating with an **elastic bougie.**

If a metal sound is used, there is always danger of lacerating the inflamed and degenerated mucous membrane and pushing the sound into the periurethral tissue, making a **false passage.** If this accident occurs, the point of the sound is felt to be not in the median line, and is grasped firmly by the tissues, and a forefinger in the rectum readily detects the deflection of the instrument. Free hemorrhage from the meatus follows the withdrawal of the sound.

The treatment of such an accident consists in rest, urethral antisepsis, urinary antiseptics, and the avoidance of instrumentation for three weeks until the laceration has healed.

In using an elastic bougie we should select a size which is small enough not to lacerate the tissues. When the bougie enters the stricture the sensation of its being engaged and grasped is perceived. If it is held very tightly, rather than attempt to push it ahead, it is better to wait a few moments till the spasm has relaxed, and then push the instrument farther along.

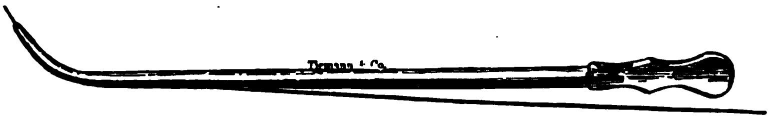

Fig. 133.—Tunneled sound.

After the elastic bougie has been passed through the stricture, it can be withdrawn at once. There is no object in allowing it to remain, since it is compressible and can not produce any absorption in the stricture; it simply dilates it mechanically. If the instrument has been introduced with comparative ease, and without much pain, we may then introduce another of a larger size.

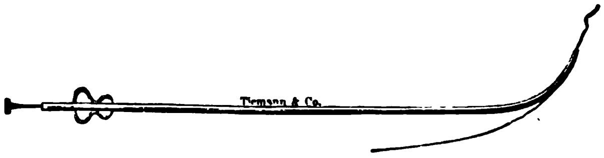

Fig. 134.—Gouley's tunneled catheter.

At the next sitting, which should not take place before two or three days have elapsed, we should first introduce the number passed upon the former occasion and then use larger sizes.

When the flexible bougie No. 16 French can be introduced with ease, we should begin **gradual dilatation with the steel sound.** It is important for the beginner to cultivate a suitable *technic* in using sounds, as unnecessary pain and sometimes actual damage to the tissues are caused by clumsy manipulation. The sound is sterilized by boiling or passing through the flame of a spirit-lamp, lubricated with vaselin or oil, and should be warm.

As the patient lies upon a table the operator stands upon his left side. Sir Henry Thompson advises that for the moment the operator should *forget* all his *anatomic knowledge,* and let the sound slip through the urethra *by its own weight,* guiding it with the utmost gentleness, and in no case should any pushing, prodding, or force be used. This is well accomplished by holding the sound *stationary,* in a line with Poupart's ligament, and drawing the penis up over it until the point of the sound has reached the membranous urethra. The sound is then brought into the median line of the body, and as the point passes *through* the membranous urethra the handle will of itself describe the arc of a circle and gradually sink down between the thighs and parallel with them. When the handle is completely depressed, it may be rotated freely from side to side, thus demonstrating that the *point* lies in the bladder and is freely movable.

The largest-sized sound should be selected which will pass through the stricture without using force, withdrawn, and a still larger size introduced. It is desirable, in order to obtain the effect of the *prolonged* pressure, not to withdraw the sound at once, but to leave it lying in the stricture for from five to fifteen minutes.

At the next sitting we should begin with the sound last introduced, withdraw it, and pass the next larger size. The sounds should not be passed too frequently, and the rule is always to *wait until the reaction has subsided* before passing the sound again. The intervals vary, depending on the amount of reaction, from four to seven days.

There are different views as to the extent to which it is necessary to carry the dilatation, some authorities claiming that No. 25 French is sufficient, others maintaining that No. 30 French is the proper caliber. In any case there is always danger of *recontraction* unless the sound is passed at occasional intervals, in order to maintain the maximum caliber, for at least eighteen months. We can introduce the sound every week, and then increase the intervals to once in two, four, six, eight, and twelve weeks.

**Effects upon the stricture of passing sounds** are twofold, according to Oberlaender and Wossidlo:

I. The mechanical stretching to which it is subjected.

II. A change in the vital functions of the tissues.

As a result of the distention, small *tears* occur in the mucous membrane or the stricture tissue, as evidenced by slight bleeding. In a few hours a profuse mucous secretion occurs, indicating that a melting of the stricture callus is taking place in consequence of the reaction. Under the increased vascularization which sets in, the stricture is partially absorbed.

After dilatation to No. 25 or 30 has been accomplished, the sound only acts upon the *narrowest* part of the stricture, and when it lies loosely here it accomplishes nothing further in the way of producing *absorption* of the stricture callus, but only keeps its caliber *mechanically* dilated. But in many cases the stricture tissue begins to recontract as soon as the use of sounds is discontinued.

Oberlaender claims that by dilating the stricture to more than No. 30 French, even 40 or 45, the fibrous tissue of the stricture is transformed into a "dead scar," which has no longer any tendency to contract. He states that, by systematic examinations with the endoscope, an evident improvement, which is perceptible to the eye, occurs only after the dilatation of the urethra has *exceeded* No. 30 French.

When the meatus is of normal size, it will not admit a sound large enough to accomplish this result, and even if meatotomy is done, the meatus can only be cut to a size sufficient to admit a No. 30 French sound, and this caliber is not enough to accomplish the *overdistention of* the urethra, according to the views of Oberlaender. On this account he has devised the **Oberlaender dilator,** which can be introduced, with the blades closed, through a small meatus; after it is in place the blades are separated by turning the screw at the end, and we can get any amount of distention of the urethra which we may desire, even as high as No. 45 French. It should be distinctly understood that *forcible dilatation* or divulsion is not intended, but only a *gradual* and *temporary* dilatation of the stricture.

**Kollmann's dilator** is a modification of Oberlaender's original idea, and is to be preferred because it is made with four dilating blades and is less apt to cause a laceration of the urethra than Oberlaender's instrument.

*Technic.*—The dilator, which is provided with a rubber cover, is oiled and introduced. If the sound which was passed on the case previously was No. 26, we separate the blades of the dilator to one number higher; i.e., to No. 27.

The blades should be separated very slowly, and after we have screwed them apart *one* number, as indicated on the dial, we should wait until the pain has subsided, and then increase the separation to the next higher number.

After each dilatation a mucopurulent secretion occurs, which indicates the melting and absorption of the stricture callus. If the discharge is profuse in quantity, it indicates that the stretching has been too vigorous. The usual intervals for dilatation are about ten days, on the average, and at each sitting the dilatation should be increased from one to two numbers.

The extent to which the stricture should be finally dilated is a matter of individual experience, and beginners generally make the mistake of dilating too rapidly. A sharp bleeding or an excessive secretion following dilatation is an indication that an error has been made in the technic, and that the dilatation has been too rapid or too great. If such an accident occurs it is necessary to wait from three to six weeks, until all tenderness of the urethra has disappeared and the secretion has diminished and is but slight in amount.

In regard to the extent to which dilatation should be carried before the stricture can be said to be cured, Oberlaender states that the endoscope is the only guide. The grayish white color of the mucous membrane changes and it becomes pink and vascular and the fibrous tissue becomes transformed into a "dead scar," which has no longer any tendency to contract. As soon as this condition is attained, all further dilatation can be suspended, quite irrespective as to whether the stricture has been dilated to No. 28 or 30, or to 40 or 45 French.

As a general rule, Wossidlo states that it is necessary to dilate up to 36 or 38 so that relapses do not occur, but, as with the use of sounds after active treatment has ceased, the stricture should be dilated, with the dilator, at occasional intervals to prevent relapses.

**Relapses** sometimes occur, and can be recognized by the endoscope and treated with dilatations again, before any decided contraction has had time to occur. For this reason, it is desirable to examine cases with the endoscope at intervals of three or six months after treatment has ceased.

With reference to treatment by dilatation, strictures may be divided into two classes, *absorbable* and *nonabsorbable*. Those which can not be absorbed can still be held in abeyance by a course of dilatations with sounds up to 30 or 32, and they may be kept at this point without contracting again by an occasional dilatation. The frequency of the dilatation will depend entirely upon the tendency of the stricture to recontract.

The length of time required to dilate a stricture is also very variable.

Some strictures can be dilated in a few weeks, and others, in which the ring of scar-tissue is extensive and very dense and fibrous, will require months of patient effort.

The only means of determining whether a stricture can be treated by dilatation is by making the attempt and observing the progress.

The opinion is now generally held, and particularly in Europe, that the great majority of strictures are amenable to treatment by dilatation, and operative treatment is seldom called for, provided the individual has sufficient patience and time to undergo the protracted course of treatment which is necessary.

In private practice it is found that most of the strictures can be successfully treated by dilatation, and it is rarely necessary to operate. The patients who enter the hospitals in a large city are of a different class. Their strictures have usually been neglected and have become very tight, and they have not the necessary time or even inclination to allow of treatment by gradual dilatation, so that from force of circumstances the genitourinary surgeon is most frequently obliged to treat his hospital patients by surgical operation.

**Strictures of very small caliber,** which are so tight as not to permit the passage of the smallest flexible bougie, can often be penetrated by means of the **filiform whalebone guide.** After this instrument has penetrated the stricture and the end has entered the bladder, there are three courses open to us:

1. **Continuous Dilatation.**—If a bougie is passed through a stricture which grasps it tightly and is left in place for twenty-four hours, the stricture ulcerates superficially, but *widens rapidly,* so that the bougie lies loosely within it, and can be withdrawn, and a larger instrument introduced to take its place.

In cases of retention of urine, a guide may be left tied in the bladder, and the urine escapes, flowing away alongside the guide.

On the following days larger instruments may be introduced and tied in until the stricture is sufficiently dilated to admit being treated with sounds.

During the course of treatment the patient lies in bed, and it is possible in this way in the course of a week or two to dilate a very tight stricture so that a good-sized instrument can be passed.

Continuous dilatation, which formerly was much in vogue, is seldom used at the present day. Methods *b* and *c* have taken its place. It has, however, a certain field of usefulness in a few selected cases.

2. **Tunneled Sound and Gradual Dilatation.**—A tunneled sound is threaded over the guide and introduced through the stricture, dilating it. The sound is then withdrawn, and a larger one intro-

duced, in the same way. This is a very useful method of treating tight strictures, which are not too hard and fibrous to admit of gradual dilatation.

In the case of retention of urine, where it is necessary to relieve a distended bladder, *Gouley's tunneled catheter* can be used in place of the tunneled sound, and the urine withdrawn through it, by pulling out the stylet and thus making the hollow shaft permeable.

3. **Immediate Operation.**—Internal urethrotomy by Maisonneuve's urethrotome or external urethrotomy. (See the following section on the operative treatment of stricture.)

## TREATMENT OF STRICTURE BY SURGICAL OPERATION

As we have before stated, a *soft* or *recent* stricture, no matter in what part of the canal it is located, is best treated by *gradual* dilatation with sounds or dilators; but, as the stricture becomes older, it grows dense, firm, and fibrous, and the gradual dilatation is no longer practicable.

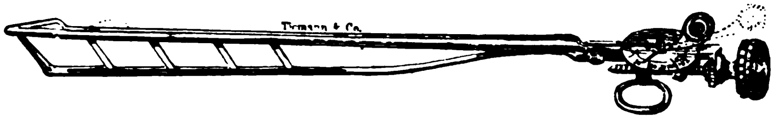

Fig. 135.—Otis urethrotome, as modified by Rand.

We are obliged to resort to a division or cutting through the stricture band by means of the knife, and to that end we employ two different operations.

(*a*) Internal urethrotomy.

(*b*) External urethrotomy.

The choice of the operation depends entirely upon the point in the urethra at which the stricture is located, and for the purpose of making the indications for operation clear we can divide the urethra into two regions:

*Region I* extends from the meatus backward for a distance of five inches, and its termination corresponds to the penoscrotal junction.

*Region II* includes the bulbous and membranous urethra. It extends from a point five inches distant from the meatus back as far as the prostatic urethra.

The operation of internal urethrotomy through the meatus is restricted to Region I, and external urethrotomy through a perineal incision is only applicable to strictures located in Region II.

## INTERNAL URETHROTOMY

**Preparatory Treatment.**—Before *any* operation on the urethra the urine should be rendered aseptic by salol, gr. x t. i. d., or urotropin, gr. vii t. i. d., and if strongly acid it should be neutralized by citrate or bicarbonate of potassium.

The urethral canal should be irrigated with oxycyanide of mercury, 1:4000, to free it from germs as much as possible.

It is desirable to fill the bladder with oxycyanide of mercury by means of a catheter, and leave the fluid in, to flow out after the operation, bathing the cut surfaces and diluting the urine, when the patient urinates later.

**Anesthetic.**—A 1 per cent solution of cocaine or novocaine is, as a rule, sufficient, unless in the case of very extreme strictures, which require a general anesthetic.

The **technic** of internal urethrotomy is as follows: If the meatus is small, it should be incised on the floor to No. 30 French, and any stricture bands which are within an inch of it should be divided at the same time with a straight, probe-pointed bistoury.

The Otis urethrotome, preferably with Rand's modification, is introduced into the urethra closed. After its point has entered *behind* the stricture the blades are separated, by means of the screw, to the full extent the caliber of the stricture will allow. The instrument is then withdrawn until the projection at the end catches against the stricture and is held. We know by the feeling of resistance that the projection which conceals the knife lies in close contact with the point we wish to cut. The knife is then withdrawn for an inch, cutting through the stricture, and toward the *roof* of the urethra. And we can afterward readily demonstrate that the stricture has been cut through by separating the blades more widely than was before possible.

The knife is again pushed back into its place of concealment in the instrument, and the urethrotome is drawn out toward the meatus, and any other stricture bands present are cut in the same way.

In every case treated by internal urethrotomy the question arises: "How deep shall we make the incision through the stricture?" This is still a point under discussion, since almost every author has his own line of procedure. Dr. Otis devised a scale of measurements of the penis, as a guide to depth of the incision, and claims that a penis three inches in circumference should be cut to admit a No. 30 French sound, while a penis four inches in circumference should be cut so that a No. 38 sound can be passed.

I believe we shall have better results by treating each case on its *individual merits.* The stricture which is comparatively *light* and does not involve the whole corpus spongiosum may be *completely* divided, as shown by the entire *absence* of *resistance* when the blades of the urethrotome are separated, after cutting the stricture.

In the case of a *heavy* stricture which involves all the corpus spongiosum we can not divide the whole thickness of the stricture, but must content ourselves with cutting it through *partially,* and trust to keeping the channel open by passing sounds *frequently* for the rest of the patient's life.

After the stricture has been cut to the extent which we desire and the urethrotome has been withdrawn, a bulbous bougie, No. 30 or 32 French, is introduced into the canal, to make sure that all the bands are completely divided.

**After-treatment.**—The patient should be kept in bed for a week, and on light diet, and directed to drink freely of water and milk to dilute the urine.

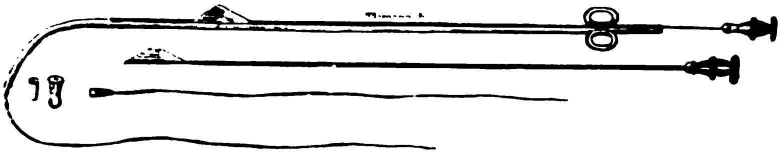

Fig. 136. Maisonneuve's urethrotome.

In order to keep the cut surfaces from growing together, a straight sound can be passed every other day for the first two or three weeks, and, after a month, once a week. Later the passage of the sound need only take place once a month; but there is always danger of *recontraction* unless a sound is passed at intervals.

**Dangers of Internal Urethrotomy.**—Mortality, 1 to 2 per cent.

(*a*) Hemorrhage.

(*b*) Infiltration of urine through wound into tissues, producing abscesses and septicemia.

(*c*) Urinary fever. It is especially important to see that the kidneys are healthy before doing an internal urethrotomy.

(*d*) Deformities of the penis subsequently.

When a deep cut is made into the roof of the urethra a large amount of scar tissue is formed in healing. This scar subsequently contracts, and bends the penis into the shape of a bow, which causes erections to be painful, and renders coitus difficult or impossible.

**Strictures of small caliber,** under No. 18 French, are not large enough to admit the passage of an Otis urethrotome. In these cases a filiform guide should be passed through the stricture and by means of (*a*) Maisonneuve's urethrotome the stricture can be divided, from before backward, and afterward cut larger with an Otis urethrotome, or we can introduce over the guide (*b*) a divulsor and ***stretch*** the stricture so that an Otis urethrotome can be used.

The operation of **divulsion** as formerly practiced has been entirely superseded, as it is inexact and dangerous, producing extensive lacerations of the urethra, which are followed by hemorrhage and septic absorption.

**Summary of Indication for Internal Urethrotomy.**—The operation is applicable only to stricture of the pendulus urethra which is dense and fibrous and can not be treated by gradual dilatation with sounds, and located *less than five inches* from the meatus.

It is especially adapted to the following varieties:

(*a*) Distinctly fibrous or nondilatable stricture.

(*b*) Resilient stricture. (*Definition:* Elastic and India-rubber-like, contracting quickly after instrumentation.)

(*c*) Irritable stricture. (*Definition:* Standing instrumentation badly and easily excited to inflammation.)

(*d*) Cases where urethral fever follows each introduction of a sound.

When a stricture is located *more* than five inches from the meatus, internal urethrotomy is no longer a suitable operation, on account of the danger of **hemorrhage,** which is difficult to control. The blood flows backward, overcomes the resistance of the cut-off muscle, and fills the bladder.

The means of controlling the bleeding are as follows:

(*a*) Pressure on the perineum by means of a crutch, firmly applied against it.

(*b*) Introduction of a full-sized catheter into the bladder, which makes pressure on the urethral walls and closes the bleeding vessels.

(*c*) Perineal section and introduction of a catheter through the wound into the bladder, with firm gauze packing around it.

Another danger is **infiltration of urine,** which soaks into the tissues through the cut and produces *abscess* and *sepsis.*

## EXTERNAL URETHROTOMY

In consequence of the dangers of hemorrhage and infiltration of urine, we have recourse to the operation of external urethrotomy through the perineum when the stricture is located in the **bulbous** or **membranous** urethra; viz., in Region II.

**Forms of Operation.**—(*a*) With a filiform guide: Gouley's operation, modified by Rand.

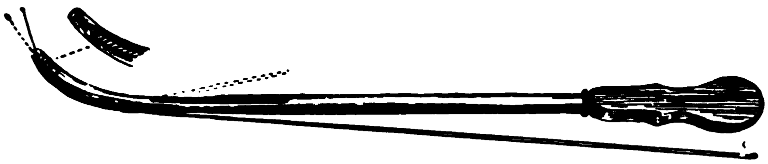

Fig. 137.—Rand's tunneled sound.

(*b*) Without a guide: Wheelhouse operation.

**Gouley's Operation with a Guide, as Modified by Rand.**—The technic of the operation is as follows:

A filiform guide is introduced through the stricture into the bladder and the patient placed in the lithotomy position.

The staff is the ordinary tunneled sound made to slip over a filiform guide, but, while the tunneled sound is provided with one groove on its convex surface, this instrument has two grooves, one on the convex side and the other on its concavity.

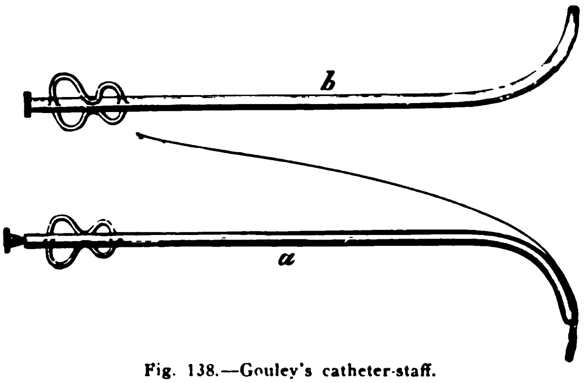

Fig. 138.—Gouley's catheter-staff.

The staff is then slipped over the guide, which lies in the groove on its concavity, the staff thus acting as a shield to prevent the accidental cutting of the guide.

The point of the staff rests against the face of the stricture and the urethra is opened in the perineum by cutting down upon its convexity near the end.

Hemorrhage is prevented by pressing with the finger and thumb on either side of the urethra. When the urethra is reached it is made to stand out prominently in the perineum by blunt dissection; it is then opened in the median line.

The staff is withdrawn from the urethra, the guide being held with forceps to prevent it from being pulled out of the bladder. The long end of the whalebone guide is then brought out of the wound in the perineum, the other end remaining in place in the bladder. Rand's knife is then threaded over the guide and pushed forward toward the bladder, and through the stricture, cutting its fibers sufficiently to admit a gorget, which is carried into the bladder.

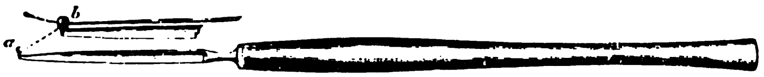

Fig. 139.—Tunneled knife.

Any remaining stricture bands which have not been severed by the ringed knife should now be divided on the floor of the urethra with a blunt-pointed straight bistoury, using the gorget as a director.

The vesical sphincter may then be dilated with a uterine dilator and the examining finger introduced into the bladder. Thorough search should now be made with the finger to exclude the presence of a calculus, which may have existed unsuspected, its symptoms being masked by those of the stricture.

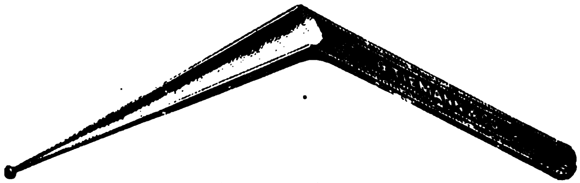

Fig. 140.—Gorget.

Operating in this way, it is possible to get on with a much smaller incision than is usually made in the urethra. If a larger incision has to be made it is usually desirable to partially close the wound in the urethra with sutures and also the skin and muscle lying over it. This partial closing of the wound around the tube hastens the process of repair materially, so that a week after the operation the patient is passing the whole or nearly all of his urine through the urethra.

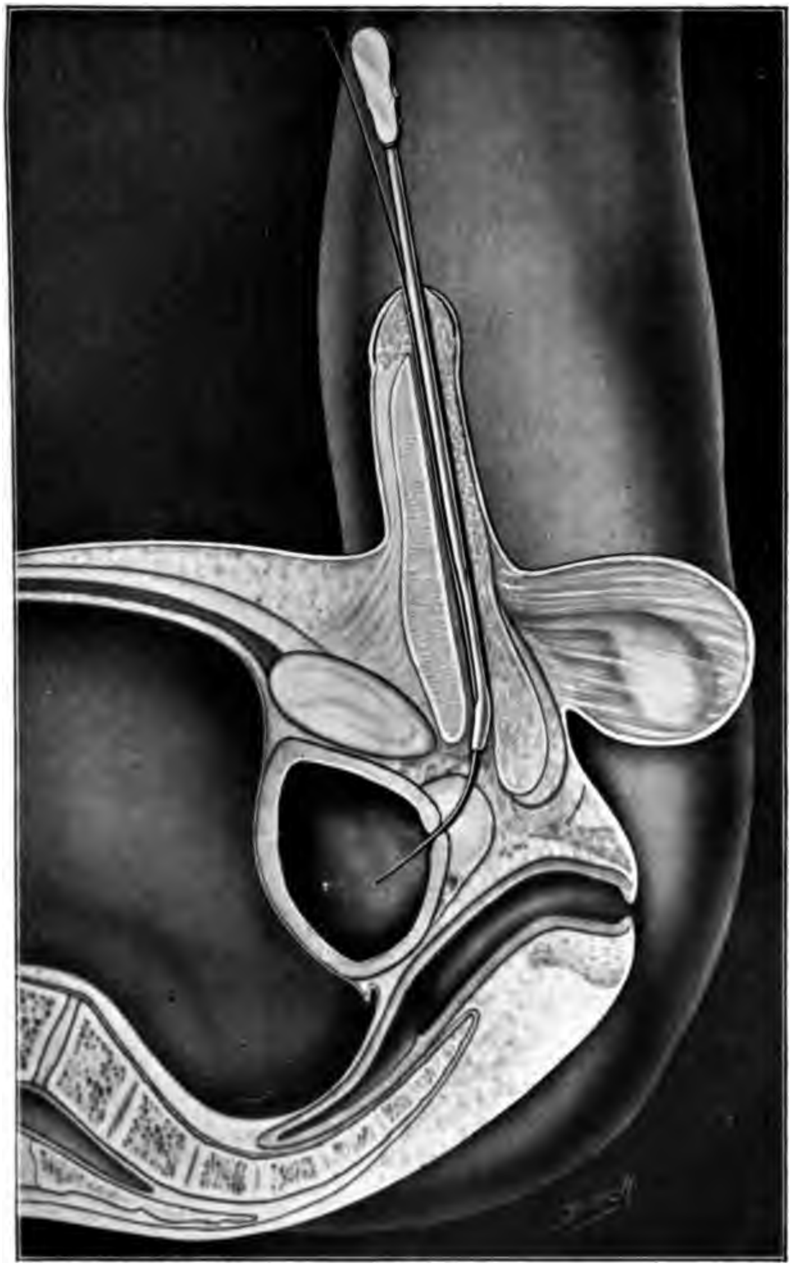

Fig. 141.—Rand's staff introduced over a filiform guide to face of the stricture.

The final step in the operation consists in introducing a large soft-rubber perineal drainage tube through the wound into the bladder and holding it in place by a stitch through both lips of the wound and the tube.

The wound is packed around the tube with strips of iodoform gauze to prevent hemorrhage.

The operation of external urethrotomy is rendered comparatively simple, if we are able to introduce a filiform guide into the bladder,

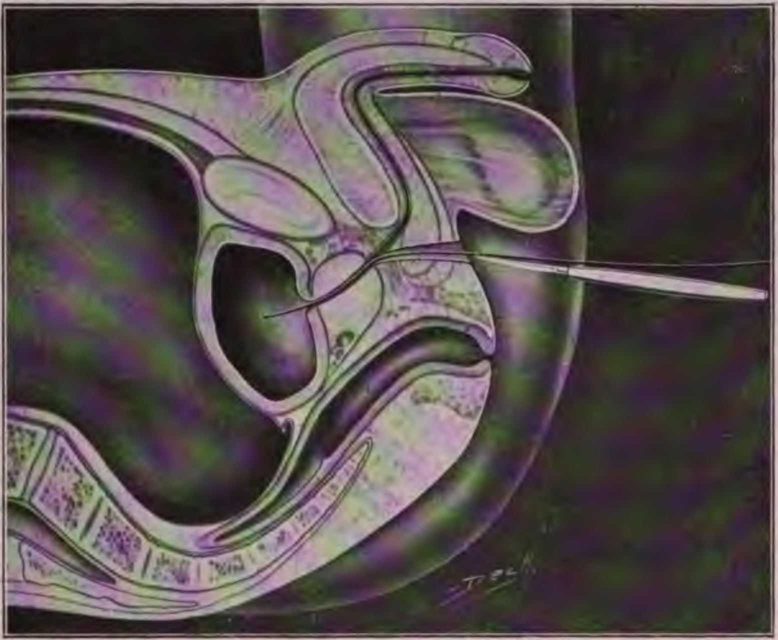

Fig. 142.—Rand's knife introduced over filiform guide preparatory to cutting stricture.

and it may be impossible to reach the bladder without the assistance furnished by the guide.

For that reason it is desirable not to wait until the last moment before the operation, but to begin the attempt to introduce a guide on the day before. If the first attempt fails, a number of subsequent trials may be made at different sittings, at one of which the guide generally slips in.

After the guide has once been introduced into the bladder through a very tight stricture, it is much safer to tie it in and leave it, rather than withdraw it and take the chances of failure in attempting to reintroduce it just before the operation.

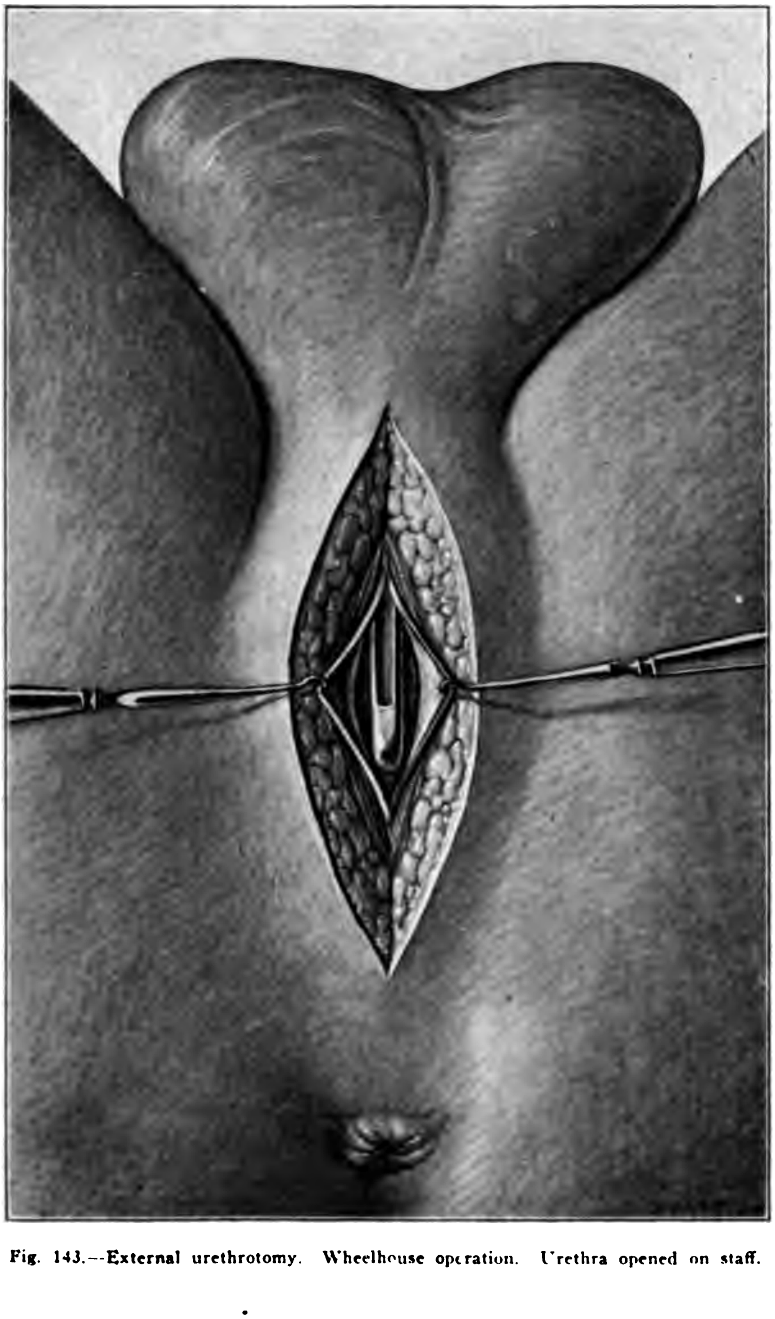

Fig. 143.—External urethrotomy. Wheelhouse operation. Urethra opened on staff.

When all attempts at the introduction of a guide are unsuccessful, the only remaining resort is the question of

**External Urethrotomy Without a Guide, as Devised by Wheelhouse.**—*Technic.*—A Wheelhouse staff is introduced into the urethra, till its end rests against the face of the stricture. The urethra is opened through the perineum, cutting down upon the end of the staff. The wound in the urethra is retracted by small hooks on either side, and the upper angle of the wound is held up by hooking the projecting end of the staff against it and drawing it as much out of the way as possible.

Search is then made for the distal end of the urethra by means of

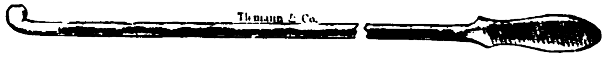

Fig. 144.—Wheelhouse staff.

Arnott's grooved probe or a filiform guide and by inspection. If the opening is found and the probe introduced, a Gouley knife is slipped along the groove in the probe and the stricture is cut through.

The chief difficulty, in the operation of external urethrotomy, consists in finding that part of the urethra which lies between the stricture and the bladder.

If the surgeon loses his way and misses the urethra, he may flounder about in the tissues of the perineum indefinitely, and ultimately have to give up his attempt to reach the bladder.

In order to avoid the danger of losing the urethra, it is essential to partially dissect out and free the urethra at the sides, so that it stands out prominently in the perineal wound as it lies distended by the staff.

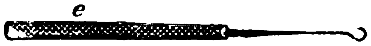

Fig. 145.—Small tenaculum for retracting urethral wound in external urethrotomy.

After the incision is made in the urethra, the edges of the urethral wound should be well retracted by a small hook at either side, and but little difficulty will be experienced in slipping Arnott's grooved probe through the lumen of the stricture with the deep urethra and bladder beyond.

In case of failure to find the opening we may have recourse to **Guitéras's trocar.** The rami of the pubis form a triangle, with the symphysis at the apex. The urethra lies immediately under and one-half inch below the symphysis.

If our anatomic knowledge enables us to locate the urethra accurately, by *stabbing* in the proper place with the trocar, we will puncture the stricture tissue, and the trocar will lie in the prostatic urethra beyond, as can be demonstrated by pushing the trocar along through it, until it reaches the bladder, and withdrawing the stylet, when a stream of urine will flow through the hollow cannula. A knife is then introduced along the groove in the instrument and the stricture divided in the usual way.

In the event of this procedure not being successful we may have recourse to **retrograde catheterization.** This operation consists in doing a suprapubic cystotomy and introducing a staff into the bladder and through the prostatic urethra and along the canal until its further progress is barred by the stricture, through which it can not pass. The end of the staff is felt, covered by stricture-tissue, by means of a finger in the wound, and the tissue which intervenes between the end of the staff and the perineal wound is cut through with a knife, in this way bringing the end of the staff into view in the wound. The urethra is thus made again one continuous canal.

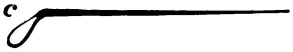

Fig. 146.—Arnott's grooved probe.

We may have recourse to still another procedure, which is to let the patient recover from his anesthetic, and when consciousness is restored and the bladder is full of urine, if the patient endeavors to pass water, a few drops of urine may be seen to escape at one point in the perineal wound, thus indicating the location of the end of the urethra, which had not been discoverable before.

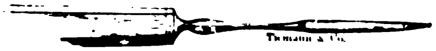

Fig. 147.—Gouley's beaked bistoury.

**Treatment After External Urethrotomy.**—*Hemorrhage* during the operation is controlled by clamping the bleeding vessels with artery-forceps, which, if necessary, may be left *in situ* for twenty-four hours in the wound, before being removed. As a rule, this is unnecessary, as the general oozing can be perfectly controlled by firm pressure by means of gauze, packed into the wound and around the catheter.

It is very essential to pack the gauze in *tightly*. The author has known of several cases where the gauze was packed in loosely and did not exert enough pressure to control the bleeding, and the patients had secondary hemorrhage from two to four days after the operation. The bleeding occurred at night and was not discovered until too late to save the patients' lives.

The treatment of secondary hemorrhage consists in taking out the gauze and clamping any bleeding points, if they can be seen; or a firm repacking of the wound with gauze will probably control the hemorrhage.

Saline injections, transfusions, or hypodermoclysis, together with strychnine administered hypodermically, are, of course, indicated in such a condition.

An important indication is to secure *good drainage of the bladder* and prevent the urine from coming in contact with the freshly made wound until septic absorption is guarded against by the formation of granulations. This is readily accomplished by carrying a No. 34 French catheter through the wound and into the bladder, and taking a stitch through both lips of the wound and the catheter to prevent it from being forced out. The end of the catheter is attached to a long tube, which drains into a bottle on the floor.

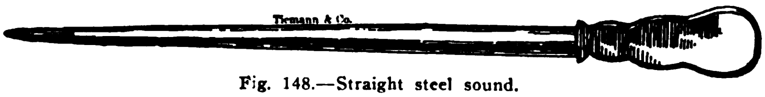

Fig. 148.—Straight steel sound.

In a case where, in addition to cutting a stricture in the deep urethra, a stricture in the anterior part of the canal has been divided by internal urethrotomy, a straight sound should be passed through the meatus and anterior urethra down to the catheter on the second day after the operation and upon every alternate day until the drainage tube is removed from the wound and bladder. The gauze packing should be removed from around the tube in forty-eight hours and the wound irrigated and repacked.

The gauze can be loosened and prevented from adhering to the wound and causing bleeding by its removal by injecting equal parts of extract of hamamelis and peroxide of hydrogen into its interstices before beginning the attempt to remove it.

It is desirable to irrigate the bladder with oxycyanide of mercury, 1:4000, once or twice a day. On the fourth or fifth day after the operation, when granulations have formed, the perineal drainage tube should be removed from the wound and at the end of a week a curved sound should be passed through the meatus into the bladder.

The sound is passed every second day into the bladder until the perineal wound is healed and the patient discharged.

The patient may be allowed to get out of bed and sit in a chair a week after the operation, and the ability to hold the water and pass it at will is regained about the same time.

**Recontraction of the stricture** is almost certain to take place, after division of a heavy stricture, unless a sound is passed at occasional intervals, for the rest of the patient's life, and this fact should be earnestly impressed upon him, so that he may not neglect the precaution.

**Résumé.**—External urethrotomy is applicable *only* to strictures located *more* than five inches from the meatus, i. e., in the bulbous and membranous urethra.

Summary of indications:

(*a*) Rupture of urethra.

(*b*) Urinary infiltration.

(*c*) Impassable stricture complicated by retention of urine.

(*d*) Tough fibrous stricture of small caliber which is difficult to dilate.

(*e*) Traumatic stricture.

## MISCELLANEOUS

**Stricture at the meatus** may be congenital or the result of gonorrhea. In these cases dilatation is useless, and the proper procedure is meatotomy, which is accomplished by cutting the meatus upon the *floor* by means of a straight probe-pointed bistoury.

There is a tendency on the part of the cut surfaces to unite afterward, which is counteracted by *dilating* the meatus three times daily with a sound, or preferably a glass cone.

**Stricture Complicated by a False Passage.**—A large number of cases of *old* deep-seated stricture, which have been under instrumentation a number of times, are apt to have one or more false passages, which have been made by the bungling use of a sound.

A false passage adds to the difficulty of entering the bladder with a catheter or sound, because it is very apt to engage the point of the instrument and "pocket" it.

In these cases the *filiform bougie* is very serviceable in furnishing a guide into the bladder. Our plan of procedure is to introduce one guide after another through the urethra, in hopes that one of them will slip *past* the opening of the false passage, pass through the stricture, and thus into the bladder.

**Combined external and internal urethrotomy** is always demanded when both pendulous and bulbous portions of the urethra are the seat of strictures.

It is also often a good plan to open the perineum and drain the bladder with a catheter after an extensive internal urethrotomy, in order to prevent the urine from passing over the fresh-cut surface in the urethra and causing urinary fever.

## PERINEOURETHRAL FISTULA

Occasionally after an external urethrotomy a permanent fistula is left in the perineum, which communicates with the urethra.

This is particularly liable to occur when a patient has been operated on several times for stricture by external urethrotomy, and when a considerable amount of scar tissue has formed in the perineum.

Urethroplasty frequently fails in these cases, because the urine leaks into the stitch holes, causing suppuration and separation of the wound-surfaces.

The author has succeeded in healing some intractable fistulæ which had been previously operated upon unsuccessfully, by the following method:

The patient is placed in the lithotomy position and a sound introduced through the meatus into the bladder.

The cicatricial tissue surrounding the edges of the fistula is dissected away and the perineal tissues separated from the urethra.

The edges of the fistulous opening in the urethra are then freshened and brought together and held by catgut sutures.

The perineal wound is then closed by means of silver-wire sutures and the bladder is drained with a retained Pezzer catheter or the patient is catheterized every four hours. The latter method is to be preferred, if competent nursing is at hand.

Firm union generally takes place at the end of a week and the silver-wire sutures may be removed.

## TREATMENT OF INTRACTABLE STRICTURE BY RESECTION OF A PORTION OF THE URETHRA

Occasionally dense fibrous strictures of the deep urethra, with a large amount of periurethral induration, are met with, which are sometimes gonorrheal, but generally traumatic, in origin.

Such patients have usually had their stricture divided by external urethrotomy several times, but, in spite of the regular passage of sounds, they contract rapidly, and it is impossible to keep them open.

A conservative method of dealing with such cases is to lay bare the urethra and excise the strictured portion.

This was first done by König in 1882, who cut out the strictured portion of the urethra and brought the separated edges again into apposition and stitched them together. In 1892 Guyon and Albarran resected strictures and allowed the space between the cut ends of the urethra to fill in with granulations.

The author has used the method devised by Fuller with satisfactory results.

**Technic.**—A sound is introduced through the meatus and the perineal urethra exposed by dissection. If the bulbous urethra is involved, the scrotum must be split in two halves in order to lay the urethra bare. The strictured portion of the urethra is entirely excised with curved scissors, with the exception of a narrow bridge of urethral tissue one-quarter of an inch wide on the roof.

A large catheter is inserted at the lower angle of the perineal wound to drain the bladder, and a No. 26 French soft catheter is passed through the meatus and perineal urethra, till its end rests against the perineal tube. The perineal tissues are then sewed around the urethral tube with catgut, thus building up a channel which will eventually form the new urethra.

The skin edges are then brought together with superficial sutures, and, if the scrotum has been divided, a couple of deep silkworm-gut sutures may be introduced.

Both tubes may be removed in one week, but a sound should not be passed for three weeks.

## EXTRAVASATION OF URINE

Extravasation of urine is one of the severest and most dangerous complications which occur as a result of stricture. It is by no means uncommon, and Sir Henry Thompson found it occurring 8 times in 217 cases of stricture.

The long-continued inflammation of the mucous membrane lining the pouch-like dilatation behind the stricture frequently causes a necrosis of the tissues and the urine escapes into the periurethral cellular tissue. The escape of the urine is also no doubt assisted by the straining and pressure of the hypertrophied bladder during its attempts at evacuation.

When, as is most frequently the case, the rupture occurs *in front* of the subpubic ligament, the urine burrows through the cellular tissue of the scrotum and penis and extends upward toward the hypogastrium.

Abscess rapidly forms, the tissues become gangrenous and slough, and spontaneous evacuation of the pus and urine occurs with considerable destruction of tissue, leaving urinary fistulæ. The septic condition is always very pronounced, and such patients usually die unless an operation is performed promptly after the rupture occurs.

When the rupture of the urethra takes place *posterior* to the subpubic ligament, the burrowing of urine takes place in a different direction. In this case the urine can not make its way forward through the cellular tissue of the penis, but it burrows under the deep layer of the perineal fascia and accumulates in the prevesical space, forming a swelling above the symphysis. From this point it extends, and inflammatory swelling and suppuration of the connective tissue within the abdomen occur, and the patient dies of pyemia.

### Treatment

Urinary extravasation demands immediate operation in order to save the patient's life and prevent extensive sloughing and loss of tissue.

An external urethrotomy should be performed and the bladder drained through a catheter in order to prevent further escape of urine into the tissues. At the same time the collections of pus and urine in the tissues should be opened up, drained freely, and packed with gauze.

If the prostatic urethra was ruptured behind the subpubic ligament and extravasation has taken place into the prevesical space, the pus and urine should be evacuated by means of a suprapubic incision.

## RETENTION OF URINE

When called to see a patient who can not urinate, the surgeon should bear in mind three possible conditions:

(*a*) **Retention of urine in the bladder.**

(*b*) **Suppression of urine** from a failure on the part of the kidneys to secrete.

(*c*) **Rupture of the bladder.**

In *suppression of urine,* percussion over the bladder shows it to be empty, and the catheter, which is easily introduced, draws no water.

*Rupture* results, in very rare instances, from a chronic ulcer being torn asunder by the violent muscular contractions of the bladder wall. It usually occurs, however, from the patient falling upon his abdomen when the bladder is moderately distended with urine.

In making a diagnosis, a catheter is introduced through the urethra and little or no urine flows out; a measured quantity of water is then injected into the bladder with a syringe, and the full amount introduced does not return.

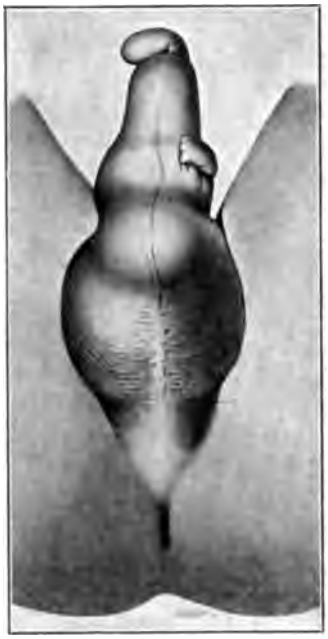

Fig. 149.—Extravasation of urine into tissues of penis and scrotum.

Having excluded rupture of the bladder and suppression of urine, we know that we are dealing with a case of retention of urine, which may arise from the following causes:

I. **Stricture,** which may be spasmodic or organic.

II. **Enlarged prostate,** from senile hypertrophy or gonorrheal inflammation.

III. **Foreign body impacted in the urethra,** as a calculus which has formed in the bladder and undergone spontaneous fracture, and a piece become fixed in the urethra; or some article may have been

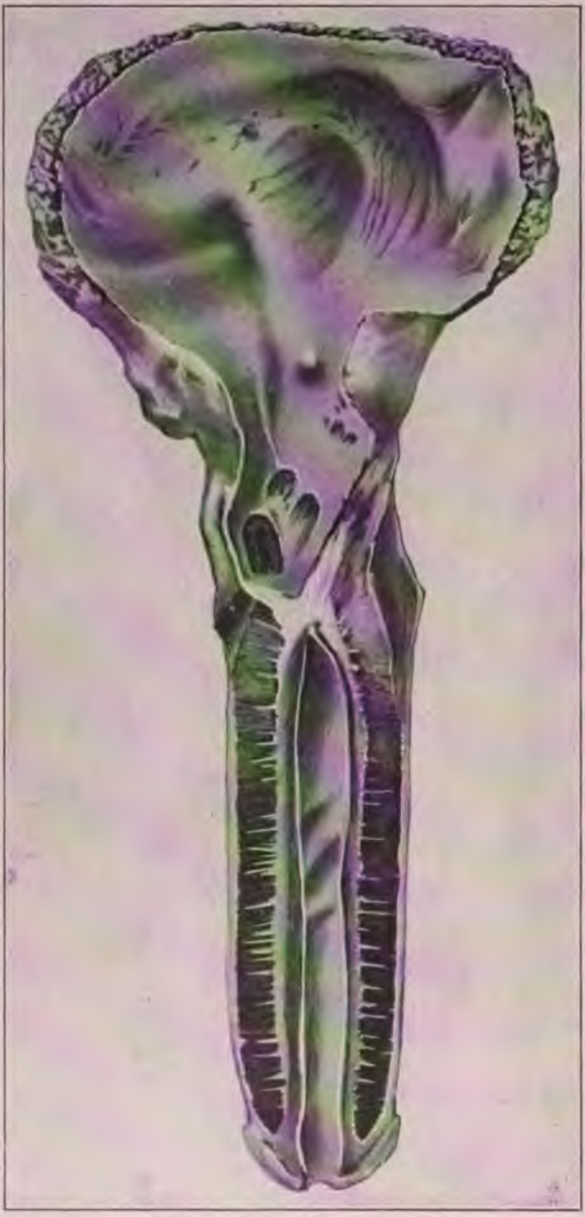

Fig. 150.—Ulceration of urethra with extravasation of urine behind a stricture.

introduced into the urethra from without, for purposes of masturbation.

IV. **Paralysis of the bladder**, occurring in typhoid and other continued fevers, or from myelitis, hemiplegia, and other nervous affections.

In order to determine which of the above conditions is responsible for the retention, a systematic method of examination is to be recommended.

Percussion over the suprapubic region gives a flat note with a full bladder, and the bladder can often be felt extending upward toward the umbilicus.

The condition and size of the *prostate* should be ascertained by rectal examination.

In cases of paralysis of the bladder no difficulty is experienced in introducing a catheter; but if the retention is due to stricture, the catheter fails to pass and the urethra should be explored with a steel sound.

If the stricture is purely *spasmodic,* a large-sized sound will generally overcome the spasm and slip into the bladder; but if the stricture is *organic,* the sound is arrested.

In very tight organic strictures which do not admit a steel sound, a filiform guide can usually be introduced.

### Treatment

If the retention is due to stricture, either organic or spasmodic, a quarter or half a grain of morphine given hypodermatically, in conjunction with a full hot bath for half an hour, often relieves the retention.

Before using the hot bath, however, an attempt should always be made to pass a catheter, either soft rubber, woven silk, or silver. If the silver catheter is used, extreme care should be taken to avoid making a false passage.

Before passing an instrument into the bladder in any case of retention of urine, the urethra should be injected with a 4 per cent novocaine or 2 per cent eucaine solution, and very thoroughly irrigated with a 1:4000 oxycyanide-of-mercury solution, in order to prevent the subsequent dangers of cystitis and urinary fever.

A spasmodic stricture is always overcome by the above measures, but an organic stricture generally proves more rebellious.

In an organic stricture, when a catheter can not be passed, the surgeon can usually relieve the retention by means of a filiform guide, introduced into the bladder with Gouley's tunneled catheter slipped over it.

Passing the filiform guide may be facilitated by filling the urethra with sweet oil by means of a syringe.

Adrenalin solution injected against the face of the stricture often causes it to shrink and open so that a guide will pass.

Sometimes it is possible to see the opening through the stricture, by means of a urethroscope, and the guide can be passed under the direction of the eye. After the guide has entered the bladder and the urine has been drawn off with a Gouley catheter, the practitioner is called upon to decide the question as to whether the patient shall be treated by *continuous dilatation* or by *operation.*

If a surgeon of experience can be secured, a stricture which is so tight that it will only admit a filiform guide is best treated by urethrotomy; but if the patient does not consent to operation, continuous dilatation will generally enlarge the stricture so that it can be subsequently treated with sounds.

In the cases where a guide fails to enter, the distended bladder may be emptied by plunging an aspirating needle through the abdominal wall, a finger's breadth above the pubis, and drawing off the urine with the aspirator. This affords only a temporary relief, as it can not be repeated more than once, on account of the danger of infection of the punctures and the leakage of urine into the space of Retzius. The last and only resource in these cases is external urethrotomy without a guide.

In the cases where the retention of urine is due to **enlarged prostate,** the treatment must be conducted on entirely different lines.

Here it is better not to waste time with a hot bath, but use the catheter at once.

In gonorrheal prostatitis the urethra should always be washed out thoroughly before passing the catheter, to prevent infection of the bladder.

In senile hypertrophy of the prostate, the distended bladder should never be emptied at one sitting, but a few ounces of urine or boric acid solution should be left in.

If the bladder is emptied entirely there is some shock, the distended blood vessels lose their accustomed support and bleed freely, and a cystitis is always aggravated if already present.

If a **foreign body impacted in the urethra** is the cause of the retention, it may sometimes be extracted with long urethral forceps.

A foreign body, however, usually calls for operation, either perineal section, or, if the body is large and lies in the bladder with part projecting into the urethra (pipestem calculus), suprapubic cystotomy may be required.

If the stone is impacted in the pendulous urethra, it may be cut down upon directly through the skin and urethral tissues. Such always heal readily by granulation without leaving a fistula.

# CHAPTER XXI

## CYSTITIS

### Etiology

It is an event of great rarity for a perfectly normal bladder to become the seat of inflammation, while, on the other hand, any noninflammatory affection of this organ is most apt to become complicated, sooner or later, by the element of germ infection, with inflammation ensuing.

There are numerous conditions which may act as **predisposing causes** to cystitis, although they may exist indefinitely without actually causing inflammation. The one most frequently met with in practice is the retention of *residual urine,* occurring in cases of stricture and enlarged prostate or resulting from paralysis of the nerve supply to the bladder, depending upon a fractured spine or a myelitis. Retention of urine in itself can not cause inflammation so long as the bladder remains free from infection with microorganisms; but stagnant urine affords an excellent culture medium for the growth and development of germs which may be introduced into the bladder, and the retention of urine, if long continued, impairs the vitality of the mucous membrane by keeping it congested.

**Chronic congestion of the mucous membrane** may occur without the presence of retained urine, and may be occasioned by calculus, some forms of prostatic enlargement, and in women by pregnancy and menstruation.

The normal epithelium of the bladder offers a barrier to the penetration of microorganisms so long as its cells are intact; but if the bladder walls are congested for some time, the superficial cells are loosened and desquamated and the softer cells underneath are exposed, allowing the entrance of germs.

The hyperemia also causes the small blood vessels to rupture, on account of the increased vascular pressure.

**Exposure to cold** is often considered an exciting cause of cystitis, but it can only act in an indirect way by lowering the vitality of the tissues, so that germ infection may the more easily take place.

The various predisposing causes above mentioned can not in themselves excite inflammation. They operate by preventing the bladder from being evacuated, and allowing residual urine to accumulate and form a favorable culture medium for germs, or by producing congestion of the mucous membrane, which lowers its vitality and causes desquamation of its protective cells, thus opening up avenues for infection.

The exciting cause of an attack of cystitis is invariably **microorganisms.** Normal urine is an aseptic fluid, free from germs, and can be injected into the peritoneal cavity without causing suppuration. In every case of cystitis various forms of cocci and bacteria are always present.

Many of these organisms are incapable of causing cystitis, if they find their way into a normal bladder, which can be completely emptied of its urine, because they are voided along with the urine, without causing any injury to the bladder.

On the other hand, the *Staphylococcus pyogenes* and the *Urobacillus liquefaciens septicus* and virulent cultures of the *Bacillus coli* possess the power of breaking up urea and forming ammonia, and on this account they are able in themselves, without the aid of a favorable predisposing cause, to excite cystitis.

**Microorganisms Found in Cystitis.**—C. Mansell Moullin[1] examined the urine from thirty cases of suppurative cystitis, most of which were old men with enlarged prostates. Cases of tubercular and gonorrheal cystitis were excluded, and the following results were obtained:

The reaction was acid or neutral in twenty-four and alkaline in six.

Microorganisms were present in abundance in all of them.

The *Bacillus coli* was present in twenty-one of the acid urines and in four of the alkaline cases.

*Streptococcus pyogenes* occurred in four acid and three alkaline cases.

The *Urobacillus liquefaciens* was present in five of the alkaline cases.

In addition, a staphylococcus was present in eight and a diplococcus in two.

These examinations show that the *Bacillus coli* is the organism most frequently present in cystitis when the urine is acid, and the *Urobacillus liquefaciens septicus* when it is alkaline.

**Bacillus coli** in shape is a short bacillus with rounded ends, which is found normally in the intestinal canal. The virulence of its culture depends upon the source from which it is taken, a growth from the contents of the healthy intestine having less virulence than one taken from a case of infantile diarrhea, while a culture from choleraic discharges is virulent in the highest degree.

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[1] Inflammation of the Bladder and Urinary Fever, P. Blakiston's Sons Co., 1898.

Unlike other microorganisms, the *Bacillus coli* has but little effect in causing the urine to become alkaline by decomposing its urea, and the urine retains its acid reaction for a considerable length of time. Although the *Bacillus coli* is a harmless saprophyte in the intestine, it has the effect, when injected into the tissues, of causing an abscess or of inducing toxemia or general septicemia.

**The Urobacillus liquefaciens septicus** is chiefly of interest from its power of decomposing urea and causing the urine to become alkaline within a few hours.

Cultures of the *Bacillus coli,* if injected into the bladder, often fail to produce cystitis unless a predisposing cause, such as retention of urine or congestion, be present.

If, however, the urobacillus gains admission to the bladder, cystitis almost invariably follows on account of the ammonia which is set free from the decomposed urea and which acts as an exciting cause for the inflammation.

**The Streptococcus pyogenes and Staphylococcus pyogenes aureus** are both capable of inducing septicemia if they gain entrance into the blood circulation, and locally they attack the bladder walls, causing diffuse inflammation with suppuration.

The streptococcus does not decompose urea, and when it is found in alkaline urine the decomposition has been effected through the agency of another microorganism, which is often the urobacillus.

Experimental and clinical evidence serves to show that, while all cases of ordinary suppurative cystitis are dependent upon these or similar organisms, inflammation of the bladder can not be induced by their mere introduction into it, so long as the urine can be completely evacuated and its walls are in a healthy condition. The *Urobacillus liquefaciens* alone is capable of exciting cystitis in a normal bladder, through its property of decomposing urea.

If, however, there be residual urine retained in the bladder, behind a stricture or enlarged prostate, or if the bladder wall is congested and eroded from the irritation of a calculus or the administration of cantharides, cystitis will surely result from the introduction of the other forms of microorganisms.

**Avenues Through which Microorganisms Reach the Bladder.**—Germs may enter the bladder by the following routes:

I. Through the urethra.

II. They may descend with the urine from the kidneys.

III. They may pass through the blood circulation direct to the bladder.

IV. They may pass through the lymphatics from adjacent organs.

*I. Infection through the Urethra.*—As already stated, the *Bacillus coli* is responsible for the larger number of cases of cystitis. Its chief habitat is the intestine, where it is always present, although varying greatly in virulence. It is also usually to be found, but mixed with other organisms, upon the glans penis, and under the prepuce and in the fossa navicularis, and in women it exists in the meatus urinarius and the folds of the vulva.

The deep urethra in the male probably does not afford a resting place for germs while it is healthy. When, however, it is altered by disease, either stricture or enlargement of the prostate, the dilated pouch, containing stagnant urine and mucus, affords a favorable hibernating place for bacteria.

Cystitis does not occur in men with healthy urethras, except as a result of instrumentation, but in cases of enlarged prostate it is of common occurrence, even when no instruments have been used. In most instances where the bladder is infected from the urethra a catheter or sound is the means by which the germs are introduced.

Although the instrument may have been sterile before introduction it may have been infected by brushing against the patient's clothing, or acquired germs from contact with the glans penis or meatus, or it may have carried germs along from a pouch behind a stricture or enlarged prostate in the urethra itself.

But, unless the predisposing causes of congestion of the bladder-wall or residual urine be present, the microorganisms will usually be swept out of the bladder with the first act of urination, without causing any damage.

*II. Infection of the Bladder, with Bacteria which Descend in the Urine from the Kidneys.*—The *Bacillus coli*, which exists in profusion in the intestinal canal, readily makes its way through the wall of the intestine into the blood circulation, and notably so, if diarrhea or intestinal disease is present. After gaining the blood circulation the bacilli are eliminated by the kidneys, and passing out with the urine gain entrance to the bladder, and under the existence of favoring conditions, such as congestion or residual urine, cystitis is excited.

*III. Infection of the Bladder through the Blood Current.*—Infective emboli occurring in the course of some general disease may be carried through the capillaries, and local foci of disease in the bladder may be originated through their agency. This cause of infection, however, seldom occurs except as a result of tuberculosis.

*IV. Microorganisms Formed in an Adjacent Organ May be Carried to the Bladder through the Channel of the Lymphatic Vessels.*—This form of infection has been proved experimentally and will serve to explain the occurrence of cystitis in women who are subjects of salpingitis and endometritis, and in whom the microorganisms probably pass from the ovaries or uterus to the bladder, through the lymphatics.

## Classification

Cystitis begins acutely, and frequently becomes chronic. Various attempts to group the varieties from an etiologic or anatomic standpoint have been made, but for practical uses a division into *simple, suppurative,* and *specific* cystitis serves the purpose.

Under the term **simple cystitis** is understood the inflammation of the bladder which is not caused by germ infection, but which results from a mechanical cause, such as the irritation from a calculus or crystals in the urine or from a chemical irritation caused by cantharides. Simple cystitis exists as a theoretical condition only, for, as a matter of fact, the complication of *germ infection* occurs in every case, and in a few hours the bladder becomes infected with microorganisms, and the simple inflammation is converted into **suppurative cystitis.**

## Pathologic Changes in the Bladder

**Location.**—The disease process is most marked in the region of the trigone and particularly so around the ureters and urethral orifice. The fundus is usually nearly or quite normal.

The mucous membrane is the part usually affected, but the inflammation may attack the deeper structures and the muscular, subserous and even the serous coats may be involved.

**In acute cystitis** the cystoscope affords a means of studying the changes in the mucous membrane of the bladder. Its color is found to be brilliant scarlet, with branching lines marking the course of the distended vessels, which bleed readily. The surface of the mucous membrane has lost its polish, is ragged and velvety, and has flakes of lymph adhering to it. In severe cases the epithelium is detached, leaving *erosions.*

In severe cases the inflammation extends to the muscular fibers and to the interstitial connecting tissue, and may lead to pericystitis.

In the presence of extensive necrosis of the epithelium and the formation of masses of fibrinous exudate which are attached to bladder wall, is presented the picture of croupous inflammation or diphtheria of the bladder wall. This is especially noted in streptococcus infections.

These fibrous exudates show a great tendency to become incrusted with urinary salts in the presence of decomposing alkaline urine.

The **pathologic changes in chronic cystitis** resemble those of the acute form, but are more marked. The erosions are deeper, sometimes forming actual ulcers. The surface of the mucous membrane is black or slate-colored, from the escape of the blood pigment into the tissues through small capillary ruptures.

In the early stages the muscular coat may undergo a true hypertrophy of its fibers, but, as a rule, the prolonged inflammation and the vascular degeneration lead in time to a condition of fibroid induration and sclerosis of the bladder wall. The walls are thicker and denser than normal and their elasticity is entirely lost. As a result of those conditions the cavity of the bladder often becomes so small and contracted that it can only hold a few ounces.

In the presence of obstruction to the emptying of the bladder its muscular fibers hypertrophy, and the bundles can be seen projecting prominently into the interior of the bladder, forming *trabeculations*. As the spaces between muscular fiber are nearly covered with the outer serous coat of the bladder, in course of time the tissue gives way to the pressure and distinct sacculations are formed.

Unless the difficulty of emptying the bladder is relieved, they bebecome stretched, forming **sac-like dilatations,** which may be as large as the bladder itself.

These sacs are only covered by serous membrane and have no muscular fibers; so that they can not empty themselves of their contained urine, and, being filled with stagnant decomposing urine, they become a favorite seat for stone formation.

On the other hand, the bladder walls, instead of being hard and fibrous around a small contracted cavity, may become thin and flaccid, and the cavity may be distended to a capacity of a quart or more.

**Membranous Cystitis.**—As a result of intense septic infection of the bladder, combined with pressure on its blood vessels, sufficient to shut off the circulation and cause gangrene, a false membrane may form within the bladder, which is thrown off as a coat of its walls.

The microscope shows these coats to be composed of epithelial cells, lymph, urinary salts, and microorganisms entangled together.

The slough may make its exit through the urethra, or the whole thickness of the bladder wall may slough into the cavity of the abdomen.

## Symptoms

### LOCAL SYMPTOMS

1. **Frequent Urination.**—The inflamed and irritable condition of the bladder walls and posterior urethra renders the bladder very intolerant of any tension, and after a small quantity of urine collects it is expelled. Prolonged standing or jolting increases the desire to urinate in cystitis and particularly so when the inflammation depends upon a vesical calculus.

2. **Painful Urination.**—In acute cases the pain is more or less constantly present over the bladder, and is aggravated by the act of urination. As the desire to urinate comes on, the pain increases, and as the bladder contracts the pain may be agonizing, and is felt in the bladder and rectum, and radiates to the end of the penis and down the thighs.

In severe cases there is a desire to urinate every few minutes, and the act of urination is accompanied by great straining or tenesmus.

In the presence of stone or posterior urethritis of gonorrheal origin, the pain is increased after the act of urination, on account of the inflamed walls of the bladder being squeezed together by the muscular contractions. Strangury is noted in the most severe cases only, in which the pain is continuous and where the patient makes violent and straining efforts to urinate and only expels a few drops of blood-stained urine each time.

In chronic cases but little pain is experienced, except in the instances of enlarged prostate, when the bladder is hypertrophied and very much contracted.

3. **Pyuria.**—Pus in the urine is a constant occurrence in every case of cystitis. If the urine is acid in reaction, the pus appears as a cloud distributed through the urine; but if the reaction is alkaline and ammoniacal, the pus is coagulated and takes the form of a viscid, tenacious, ropy mass, at the bottom of the vessel.

4. **Hematuria.**—A slight amount of bleeding occurs from a rupture of the congested capillaries in the bladder walls, in all cases of cystitis. The blood is always intimately mixed with the urine and disseminated through it. A gush of pure blood following the act of

urination is a characteristic sign of inflammation of the posterior urethra.

### CONSTITUTIONAL SYMPTOMS

The constitutional symptoms in cystitis are caused by the toxins which are absorbed into the circulation, and their severity depends upon, first, the amount of the poison absorbed, and, secondly, upon the rapidity of its absorption.

If the bladder is able to empty itself thoroughly, absorption does not take place to any great extent and the constitutional disturbance is not marked.

If, on the other hand, the bladder can not evacuate itself completely, or if pyogenic organisms have invaded its walls, severe constitutional disturbance follows.

**In acute cystitis** the bladder can usually empty itself, and the temperature it not high and the constitutional symptoms are not particularly marked; but if, from some cause, obstruction to the outflow of urine exists, and the protecting epithelium has been desquamated from the bladder wall, an opportunity for the absorption of toxins is afforded and the constitutional symptoms are grave.

This is particularly true in cases of mixed infection, in which the *Bacillus coli* is associated with the *Urobacillus liquefaciens septicus* or *Staphylococcus pyogenes.*

The ammonia which is formed from the decomposed urea helps to break down the protecting layer of bladder epithelium, and the erosions thus formed allow large quantities of toxins to pass rapidly into the blood circulation.

In old men at the beginning of catheter-life, an asthenic form of cystitis is not uncommon. It is always associated with chronic urinary fever and is often fatal.

**In chronic cystitis** the constitutional disturbance is slight, because there is very little absorption of toxins from the bladder. Grave symptoms occur only when an acute attack is ingrafted upon a bladder which has suffered with chronic inflammation. Some organism which is capable of decomposing urea enters and ammonia is formed. The tissues, altered by long-continued inflammation, respond violently to the irritant, the kidneys become involved, and septic poisoning follows.

## Diagnosis

It is most important for the practitioner not to be deluded into being satisfied with dismissing a patient wih a diagnosis of cystitis

### Causes of Persisting Cystitis

| | | | |
|---|---|---|---|
| Chronic Irritant | 1. *Calculus* | | |
| | 2. *Foreign Bodies* | Introduced through urethra | Catheter tips<br>Hairpins<br>Buttons |
| | | In other ways | Bullets<br>Bone fragments |
| | 3. *Neoplasms* | Particularly papilloma | |
| Incomplete Emptying of Bladder | 1. *Obstruction* | Displacements | Prolapse<br>Cystocele |
| | | Extravesical tumors | Fibroids, etc. |
| | | Perivesical adhesions | |
| | | Urethra | Small meatus<br>Stricture |
| | | Bladder neck | Prostatic adenoma<br>Prostatic carcinoma<br>Contracture |
| | 2. *Disturbance of Innervation* | Tabes<br>Other diseases of central nervous system | |
| | 3. *Diverticula* | Congenital<br>Acquired | |
| Pus Foci | 1. *Kidney* | Stone<br>Tuberculosis<br>Other infections | |
| | 2. *Lower Genito-urinary Tract* | Urethra<br>Prostate and vesicles | |
| | 3. *Pelvic Abscess* | Direct connection<br>Lymphatics | |
| | 4. *Fistulæ* | Uterus<br>Vagina<br>Rectum<br>Other parts of intestinal tract | |

merely because he complains of frequent urination, tenesmus, and pus in the urine. Such symptoms call for a complete investigation of the kidneys, prostate, seminal vesicles, and urethra, as well as the bladder itself. The presence of pus or blood in the urine, however, only signifies that there is a condition of suppuration somewhere along the genitourinary tract. In chronic cases of cystitis it is always important to exclude such local conditions as stricture, stone, or enlarged prostate, and in acute cases the absence of gonorrheal or tubercular infection should be ascertained and the state of the prostate and seminal vesicles should always be examined.

The use of the *cystoscope* is not admissible in acute cases, on account of its increasing the existing irritation, but in chronic cystitis it is indispensable. By its means it is possible to exclude malignant disease and tuberculosis of the bladder and calculus, and the presence or absence of an enlarged and projecting middle lobe of the prostate can be readily ascertained.

Pyelitis can at the same time be diagnosed or excluded, sometimes from the appearance of the ureteral openings, but with absolute certainty by catheterizing the ureters.

The *microscopic* examination is almost as important, to determine the character of the microorganisms, the variety of the urinary crystals, and the form of the epithelial cells, from which some conclusion as to the involvement of the kidneys may be drawn.

Saccular dilatations can be seen with the cystoscope, but can not be explored in their depths. For the accurate diagnosis of the shape and location of these diverticula it has been suggested to take radiographs of the bladder after it has been filled with a solution of argyrol or collargol.

As an aid to students the following is a table of causes of chronic cystitis which was prepared by Dr. N. P. Rathbun:

### Prognosis

Acute cystitis may heal completely or it may become chronic.

The cure of chronic cystitis depends entirely upon its causation. When it is due to stone, stricture, or enlarged prostate, and its cause can be removed by surgical interference, the prognosis is good.

Chronic cystitis, if permitted to go on without discovering and removing the cause, ultimately causes the death of the patient, through ascending infection by way of the ureters; and pyelitis or pyelonephritis is caused, which proves fatal in the end.

In the aged and debilitated a speedier death may be induced by absorption of toxins and urinary fever, in which the kidneys are also involved and death occurs more rapidly.

### Preventive Treatment

Suppurative cystitis is always caused by microorganisms, of which the most common form is the *Bacillus coli communis*, which originates in the intestine and may make its way into the bladder through the urethra, general blood circulation, or lymphatics.

Under ordinary conditions the *Bacillus coli* is a harmless saprophyte, but diarrhea, constipation, and other intestinal disorders convert it into an extremely virulent pyogenic germ. Hence it follows that the intestinal canal should be kept as aseptic as possible by means of calomel, purgatives, and intestinal antiseptics. Local foci of infection, where germs can grow in the urethra and around the external genitals of the male and female, should be kept clean and aseptic.

As long as the mucous membrane lining the bladder remains unbroken and the organ is capable of being completely emptied of its contained urine, bacteria may be introduced into the bladder without harm, as they are soon flushed out by the stream of urine, and cystitis can rarely be induced unless the bladder wall has been congested and the epithelial lining eroded or it contains residual urine, caused by an enlarged prostate, stricture, or vesical atony. On this account it is important to attend to any local diseased conditions which interfere with its proper emptying, and allow residual urine to accumulate or the bladder walls to become congested and eroded.

Catheters and sounds must be sterile before using, and the external genitals should always be cleansed before instrumentation (see section on Asepsis of Instruments).

### General Treatment of Acute Cystitis

In all but the mildest cases, the patient should be kept in bed until the severity of the symptoms is controlled and the acute stage is past.

The room should be maintained at an even temperature, for the congestion of an inflamed bladder is notably increased by chilling the surface of the body and by the muscular efforts of walking.

**Purgatives.**—A brisk calomel purge should always be administered at the beginning of an attack, for the purpose of clearing out the intestine, which is the main source from which the *Bacillus coli* is derived. It has been shown experimentally that rectal obstruction is almost immediately followed by the appearance of enormous numbers of colon bacilli, which come either from the kidneys or directly from the rectum to the bladder through the thin intervening walls. During the progress of the case a daily movement of the bowels should be secured by Hunyadi or Rubinat water.

**Hot sitz-baths** at a temperature of 100° or 105° F. are serviceable in allaying the vesical irritability and tenesmus. The exposed part of the patient's body should be well covered with blankets while taking them.

**The diet** should be light and largely composed of milk. Meat should not be allowed at all or only in small quantities. Fresh fruit may be taken in moderation. Alcohol is interdicted unless perhaps in old men who need a stimulant, in which case whiskey well diluted may be used.

**Diluents.**—Pure spring water or distilled water may be taken freely, unless the desire to urinate is very frequent and urgent. The various infusions of triticum, buchu, etc., probably render the urine bland, simply through the water they contain. Alkalies should never be administered as a routine measure, since in cystitis the urine is frequently alkaline from decomposition of urea into ammonia or from a fixed alkali, and the internal use of alkalies does harm by increasing the alkalinity. If the urine is highly acid and deposits uric acid crystals, bicarbonate or citrate of potassium is useful in allaying the irritation.

**Opium** is often required in acute cases to control the vesical tenesmus, pain, and irritability. It is given preferably in ½-grain morphine suppositories, but may be used by the mouth as well. It is unwise to inject morphine into the bladder. If the bladder mucous membrane is unbroken it will not be absorbed, and if erosions are present absorption may occur too quickly and give rise to symptoms of poisoning.

The same holds true of **cocaine**, which has little or no effect in causing local anesthesia of the bladder, as it does in other mucous membranes, and has the great disadvantage of very materially increasing the congestion of the mucous membrane, at times sufficiently to cause retention of urine.

**Balsams.**—Sandalwood oil has a very beneficial action in allaying the too frequent urination and pain of cystitis, in its acute stage. Its antiseptic action is not very strongly marked except on the staphylococcus on which it seems to have a specific action and this may apply to cocci generally.

In the later stages of a cystitis when the secretion of pus has diminished so that the urine, instead of being turbid, presents only a fine cloudiness, the oleoresins, such as turpentine, copaiba, cubebs, fluidextract of pichi, and minute doses of cantharidin dissolved in alcohol, have an effect in quickly causing a cessation of the suppuration and a clearing up of the urine.

**Urinary Antiseptics.**—Urotropin is the best agent which we possess for destroying organisms in the bladder. It is not itself an antiseptic, but acts by producing formaldehyde in the urine. This only takes place in acid urine and the drug is inert in alkaline urine.

The degree of antiseptic power is proportionate to the acidity and where this is normal the drug is far the most efficient of all the urinary antiseptics.

In order to attain the desired action of urotropin, acid sodium phosphate or benzoic acid should always be combined with it, in the presence of alkaline urine and the urotropine may be used in doses of 15 to 30 grains three times a day.

The other antiseptics are not so valuable as the one just mentioned, but boric acid, salol and methyl blue are moderately effective at times.

Salol is given in doses of gr. x three times a day, and acts promptly as a destroyer of microorganisms, through the constituent carbolic acid, which, from its decomposition, is set free in the urine. In the same way boric and benzoic acids, in doses of 20 grains per day, exercise their germicidal power, and are to be chosen when the urine is alkaline in reaction from the presence of a fixed alkali.

In the group of aniline derivatives may be mentioned methyl blue. Methyl blue, first recommended by Einhorn, in the quantity of 15 grains a day in tablets or capsules, is often of service when the urine contains large quantities of bacteria. The urine, from using this drug, becomes greenish at first in color and later of an intense blue.

**Vaccines.**—In recent times some benefit has been derived from the use of vaccines in cases of severe acute cystitis, especially in those due to infection with the colon bacillus.

An autogenous vaccine is to be preferred if it can be obtained. If not, a stock vaccine may be used, and, in connection with other measures, may be of some assistance in controlling the condition.

## Local Treatment of Acute Cystitis

Bladder-washing, which is so essential in chronic cases, is entirely inadmissible in the acute forms. The only varieties of local application which can be used without doing harm are:

**Instillations of Nitrate of Silver.**—These can be used with advantage in the most acute cases of cystitis. The principal indications for their use are painful and frequent urination, provided the bladder is capable of emptying itself. By means of an Ultzmann syringe 20 drops of nitrate-of-silver solution, increasing in strength from gr. j to gr. x, are deposited every second or third day in the posterior urethra, from which point it flows back into the bladder and trickles over the surface of the trigone, which, together with the posterior urethra, are the parts most involved in the inflammatory process. The bladder should be empty, before instillation, as the nitrate of silver is neutralized if it comes in contact with urine. Instillations are mainly useful in acute cases, although sometimes of service in chronic cystitis.

### General Treatment of Chronic Cystitis

After the severe pain and frequent urination of the acute stage have passed off, the urine still contains pus in large quantities and has to be voided more frequently than in the normal condition.

The patient should no longer be confined to bed, but should have the benefit of the fresh air, although much walking is, of course, out of the question for him. He should be instructed to clothe the body in flannel, to wear woolen stockings, and rubber overshoes in damp weather, and cautioned particularly to avoid exposure to a draft or dampness.

The sandalwood oil is of less use in chronic cases than in the acute, but the oleoresins are of value, and the urinary antiseptics, urotropin and salol, have here their field of greatest usefulness. By means of the general treatment but little can be accomplished, and the main reliance is the local treatment.

### Local Treatment of Chronic Cystitis

**Indications.**—I. *Remove any local source of irritation within the bladder or any obstacle to its evacuation.* Palliative measures for the cure of cystitis are of no avail if a calculus or tumor is allowed to remain within the bladder, or a stricture or enlarged prostate causes residual urine to accumulate.

II. *Remove the urine from the bladder and keep it empty.* In cystitis, if the bladder is able to empty itself completely, the microorganisms are soon swept away and the attack is over; but if residual urine is allowed to remain and become stagnant, it affords an excellent culture medium for the growth of the germs.

The simplest form of drainage of the bladder is by means of a soft-rubber catheter passed once a day or oftener, as needed; but in atonic bladders, or severe cases, this is not sufficient and the bladder *must be kept empty.*

**Permanent catheterization** is an extremely useful and often-employed procedure of the genitourinary surgeon.

It consists in passing a woven-silk catheter into the bladder and tying it so that it can not be expelled by muscular contraction.

A self-retaining Pezzar or Malecot catheter can be used for the same purpose.

The catheter may lie in the bladder for a week or ten days, or even longer, without causing the slightest harm, except for a light degree of urethritis or, very rarely, epididymitis.

The effects of keeping the bladder empty are followed by an improvement within forty-eight hours, especially in the case of old, feeble men with chronic urinary fever and damaged kidneys who are suffering from toxemia and too feeble to stand the slight operation of perineal section.

The delirium passes; the tongue, instead of being dry and brown, becomes moist, and the appetite and strength return and the local condition of cystitis improves.

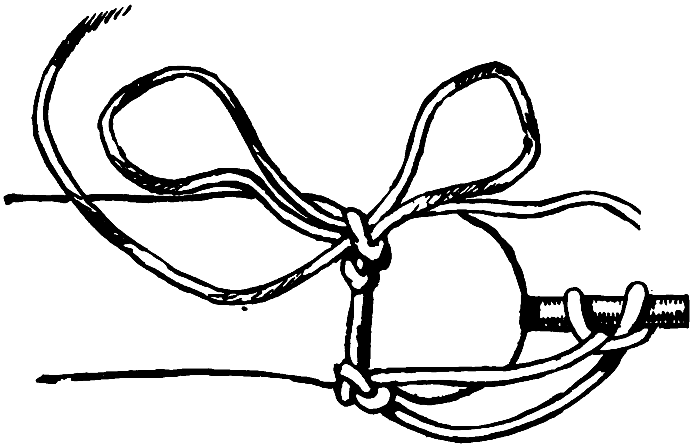

Fig. 151.—Tying catheter in the bladder.

Since the practice of preliminary treatment with the permanent catheter before prostatectomy has been generally adopted, a distinct lowering in the mortality rate is observed, and cases of postoperative anuria are now seen far less commonly than formerly.

In cases where the catheter is badly tolerated or the patient in his delirium pulls the catheter out, it may be necessary to resort to an incision in the bladder for purposes of drainage.

**Perineal Drainage.**—Technic of *Operation.*—A lithotomy-staff is introduced into the bladder through the urethra and an incision is made through the perineum, into the membranous urethra, by thrusting a long, straight bistoury an inch and a half in front of the anus, until its point strikes the groove in the staff. A gorget is introduced into the bladder through the wound and a No. 30 French soft-rubber catheter carried along it, till its eye lies within the cavity of the bladder.

A silk suture is then passed through the skin of the perineal wound and the catheter, in this way keeping the catheter from being forced out by the contractions of the bladder.

Instead of a rubber catheter, Watson's silver perineal drainage-tube may be used in cases where the bladder is tolerant; but the metal tube is apt to excite more pain than the soft-rubber catheter.

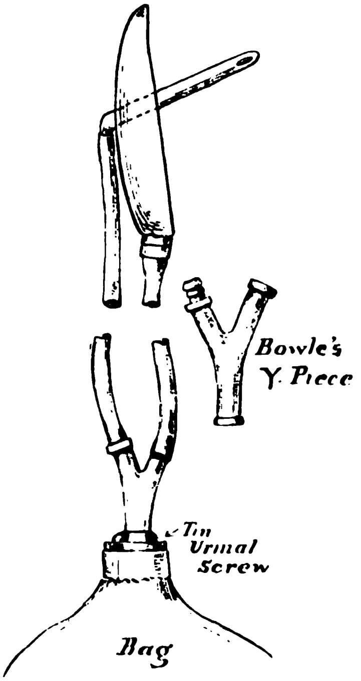

Fig. 152.

The catheter is attached to a rubber tube whose end lies in a bottle on the floor to receive the urine. In this way the bladder is kept entirely empty, and can be thoroughly cleansed by irrigations.

The length of time during which the drainage is to be maintained varies greatly, depending upon the degree of the cystitis. It should be continued until the urine is free from pus and acid in reaction and the muscular walls of the bladder have regained their tone, and this, in a severe case of long standing, may require some months.

**Suprapubic drainage** is to be preferred to drainage through the perineum, when it is continued for some length of time, as the flow of urine through the abdominal fistula can be received in a rubber bag under the patient's clothing and he can go about and keep dry.

The operative treatment is resorted to only in particularly severe cases, which on account of extreme tenderness make all local means of treatment impossible. Such instances occur in patients with contracted bladders and but little residual urine. They suffer from constant pain and frequent and painful urination, with the discharge of a few drops of ammoniacal urine each time. Again, in inveterate cases of chronic cystitis, where the bladder is atonic and perhaps sacculated, and where bladder washing and instillations have been used without effect, permanent drainage through a fistula often causes a marked improvement.

### Curettage of the Bladder

In recent years the fungosities have been removed from the bladder wall by means of a sharp curette introduced through a perineal or suprapubic incision, and in some cases it has seemed to be of benefit.

It can readily be performed without any risk at the time the bladder is opened for the purpose of prolonged drainage.

III. *Destroy microorganisms or check their growth and remove pus and fermentation products from the bladder by means of irrigation of the bladder.* **Washing the bladder** is the most efficient mode of cleansing the bladder walls of adherent pus, microorganisms, and urinary salts. The microorganisms which lie beneath the mucous membrane can not be reached, but, by lessening the congestion of the mucous membrane and removing decomposed urine, it is put in a condition which favors its recovery.

Although the bladder can be filled by hydrostatic pressure from an irrigator, it requires a catheter to wash it out. The only suitable forms of catheter are the soft rubber and the gum elastic. They should be of large size and provided with two eyes, as the stream flowing through them stirs up the stagnant urine more effectually if it enters the bladder from two directions.

A large glass-and-metal syringe holding five ounces may be used, and has the advantage that it is possible to judge of the extent to which the bladder is filled by the feeling of resistance to the inflowing stream offered by the muscular walls of the bladder. The successive jets entering also set up contractions of the muscular walls, which have an influence in restoring their tone, and the introduction of fluid in this manner also forms rapid currents in the bladder which effectually cleanse its walls from adherent pus.

The general custom is to use an *irrigator* raised to the height of two to four feet and attached to the catheter by a short glass connecting tube. The patient should rest upon a table or sofa in a half-sitting position, and the anterior urethra should be irrigated to cleanse it, before the catheter is carried into the bladder.

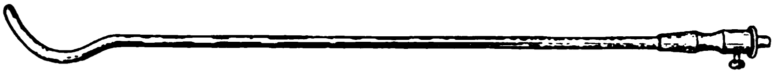

Fig. 153.—Mandril for introducing a Pezzar catheter.

As soon as a sense of resistance is perceived or the patient feels pain, the inflow should be stopped, and after a short pause the fluid be allowed to flow out again, and the proceeding repeated until the solution comes away clear. The amount of fluid necessary to flow in at one time is small: 60 to 150 c.c. (from 2 to 5 ounces) is enough.

Reginald Harrison and others state that it is impossible to cleanse the bladder in this way, and strongly advise the piston syringe as the only proper method of bladder washing.

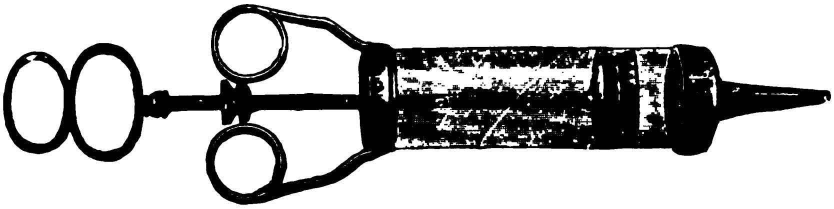

Fig. 154.—Janet-Frank syringe. (Kny Scheerer Company.)

## Solutions for Washing the Bladder

For simply cleansing the walls of the bladder and removing adherent pus and decomposing urine, normal salt solution, 0.6 per cent, or boric acid water, 4 per cent, in strength are well adapted to the purpose. Salicylic acid 3:1000, has some effect in checking the fermentation process.

On account of the bacterial origin of the cystitis, many antiseptics have been recommended, but on more extended trials they have proved disappointing and have fallen into disuse.

**Nitrate of silver** is an exception to the antiseptics just mentioned, and is the most valuable remedy we possess in suppurative cystitis. It should be used in the strength of 1:4000 up to 1:1000, beginning with the weaker and gradually increasing. The solution should be retained in the bladder two or three minutes and then allowed to flow out again. If much pain is caused it may be neutralized by washing afterward with salt solution. The application should be made every two or three days. Permanganate of potassium or oxycyanide of mercury is less useful than nitrate of silver in cystitis, but is occasionally of service.

In chronic cystitis, when the bladder is contracted and much pain is complained of, the distention attendant upon washing the bladder contraindicates its use, and instillations of nitrate of silver have to be substituted. Twenty drops may be used every two to four days, from gr. v to x in strength.

## SPECIFIC CYSTITIS

### Gonorrheal Cystitis

Statistics show that the posterior urethra is involved in 80 per cent of the cases of gonorrhea, but a true cystitis arising from infection of the bladder mucous membrane with gonococci is extremely rare, although a few cases have been recorded.

Inflammation of the trigone of the bladder frequently occurs during the course of a gonorrhea, after the posterior urethra has been attacked, and is almost always due not to the entrance of the gonococci into the bladder, but of some other pathogenic organism, and the infection is therefore of the mixed variety.

Its symptoms, course, and treatment are those of the ordinary forms of suppurative cystitis, and have already been discussed under that heading.

## TUBERCULOUS CYSTITIS

Tuberculous involvement of the bladder occurs most frequently in young adults between the ages of 15 and 40, although no age is exempt.

## Modes of Infection

*Primary infection* of the bladder is of rare occurrence, although it is met with occasionally, for, so long as the vesical epithelium is intact, it affords an efficient barrier to the entrance into the tissues of any tubercle bacilli which may have found their way into the bladder. If the mucous membrane has been injured or eroded by the action of ammoniacal urine, the tubercle bacilli can easily enter the tissues. For this reason primary tuberculosis of the bladder is rare, and when a bladder becomes tuberculous it is usually infected from a deposit elsewhere.

*Secondary infection* of the bladder may result from the direct extension of a tuberculous infiltration of the seminal vesicles or prostate, or the bacilli may be conveyed by the lymphatics or blood circulation from the kidneys or testicle. Most of the cases of bladder tuberculosis, however, originate from the mural transplantation of tubercle bacilli contained in the urine from a tuberculous kidney, which descend with the urine.

## Pathologic Changes

The tubercular deposit always begins around the vesicourethral orifice and trigone or around the ureteral openings. The process does not last as long as pure tuberculosis, for it is soon complicated by infection with other microorganisms, causing suppurative cystitis and ammoniacal decomposition of urine.

A *cystoscopic* examination made early in the case shows a few minute papules or pinhead-sized ulcerations, and later in the disease are to be seen irregular-shaped ulcerations covered with a deposit of urinary salts and sloughing material, and the base of the ulcer may be coverd with fungating granulations, which bleed easily.

The walls of the bladder in some places become hard and rigid and in others are softened, and its capacity is diminished, so that it may only hold a few ounces of urine. The cellular tissue surrounding the base of the bladder becomes the seat of multiple abscesses, which break and form fistulæ.

## Symptoms and Course

Tuberculosis of the bladder begins insidiously, and often without any apparent cause. Its symptoms are those of cystitis, viz., frequent urination, pyuria, and hematuria. Bleeding is a prominent symptom, appears early in the disease, and is more or less persistent throughout its course.

In the later stages, after ulceration has made its appearance, the striking symptom is the painful and frequent urination, occasioned by the contraction of the walls of the bladder and the ammoniacal urine coming in contact with its ulcerated walls. The endeavor to rid the bladder of the irritating urine causes straining every few minutes, which is accompanied by intense pain, and the urine contains considerable quantities of blood. The tuberculous foci which first appeared in the kidney have been increasing in size and breaking down, and on operation or *postmortem* the kidney is usually found riddled with abscesses or converted into a pyonephrotic sac.

The septic fever, constant pain, and rapid loss of weight and strength finally, in the course of a variable time, result in the death of the individual, unless the tuberculous focus in the kidney is removed by early operation before involvement of the other kidney.

It is surprising to see the rapidity with which extensive tuberculous ulcerations of the bladder heal after removal of a tuberculous kidney and cessation of the continued entrance into it of pus cells containing tubercle bacilli.

## Diagnosis

Tuberculosis should always be suspected when a young man of tuberculous heredity develops a cystitis without any apparent exciting or predisposing cause, which runs a very persistent and intractable course, and is not cured by the ordinary treatment.

It may be laid down as a safe rule to follow to suspect tuberculosis of the kidney and bladder in every case of cystitis in young persons which is not due to stone or stricture and does not get well under bladder washing with solution of nitrate of silver.

In fact, the effect of nitrate of silver on a tuberculous bladder is highly diagnostic in itself, for it always increases the pain, tenesmus, and bleeding. When this effect is noted in an apparently mild case of cystitis, close search for tuberculous deposits in the kidney should be made, for too much delay in removal of the infected kidney jeopardizes the patient's life. (See Renal Tuberculosis.)

A *microscopic* examination of the pus from the bladder confirms the diagnosis of tuberculous cystitis by disclosing tubercle bacilli.

There may be difficulty in finding the bacilli, even after centrifugating, as they are often scanty. If none are found, the sediment may be injected into the subcutaneous tissue over the abdomen of a guinea pig. If the animal is killed four weeks later, and the lymph glands are tuberculous or tuberculous nodules are disseminated throughout the body, the diagnosis is established.

A careful search should always be made for tuberculous foci in neighboring organs, and nodules may usually be found in the prostate, seminal vesicles, or epididymis.

*Tuberculous involvement of the kidney* generally exists and is often overlooked. The symptoms are not marked; there is an absence of renal pain and colic and no tenderness on pressure. It may be suspected, however, when the urine is persistently of a low specific gravity and acid in reaction, and when the pyuria is intermittent in character, and the amount of pus is greater than could be furnished by ulcers in the bladder.

The tests for tuberculin reaction (von Pirquet and Morro) may be tried, but, while very accurate in young children, are not to be depended upon much in adults, and, with the accuracy of the findings with the cystoscope, the presence of tubercle bacilli in the urine and animal inoculations, the diagnosis can be positively established without resorting to the reaction tests.

*Cystoscopic examination* discloses in the early stages a number of pinhead-sized, round, grayish, transparent nodules surrounded by a normal condition of the unaffected mucous membrane. After the destruction of the nodules, they present the appearance of dark red spots of the size of a pea, and in descending infections are most apt to be located about one ureter mouth.

In more advanced cases the nodules can no longer be seen in the swollen mucous membrane, but generally small multiple ulcers are present.

When the stage of ulceration has been reached, cystoscopic examination is attended with considerable difficulty.

The necessary distention of the bladder with fluid causes free bleeding, which obscures the view, and the local conditions may be made worse by its stretching.

For these reasons it is better only to use the cystoscope when a radical operation is contemplated, for the purpose of accurate diagnosis and separation of the urine.

### Prognosis

The prognosis in tuberculosis of the bladder is not bad in the cases of descending infection, if a nephrectomy is done early enough, and it is most gratifying to observe the improvement in the urinary symptoms and the healing of the ulcers after the constant discharge of pus from the kidney into the bladder has been stopped by the removal of the kidney.

In the cases of involvement of the bladder secondary to tuberculosis of the prostate and vesicles or of the lungs, the outlook is hopeless.

### Treatment

The attempt has been made by Guyon, Reverdin, and others to cure vesical tuberculosis in its earliest stages by opening the bladder above the pubes and curetting out the ulcers.

The resort to surgical measures in the beginning of tuberculosis of the bladder in the hope of curing the disease is today abandoned. The bladder infection is almost always secondary to tuberculous deposits in other organs, most frequently the kidneys, and surgical interference in the majority of cases only increases the rapidity of the course of the disease.

The only rational way of treating tuberculosis of the bladder is to individualize each patient as to whether he is suffering from a descending infection from the kidneys, a tuberculosis of the prostate and vesicles, or a pulmonary tuberculosis.

The hygienic and dietetic general treatment suitable for all tuberculosis cases is demanded, to assure the cure after operation and to retard the progress in the inoperable cases.

Urotropin is of some value, especially when a mixed infection has taken place. The pain is relieved by morphine, and in the inoperable cases it is the only means which gives the patient any relief from the intolerable pain and tenesmus.

**Local treatment** is harmful, as a rule. The tuberculous deposits can not be reached, and there is danger, in bladder washing and instillations, of introducing pus organisms and causing suppurative cystitis. After this has occurred, the instillation of corrosive sublimate (Guyon), using 20 drops of 1:5000 solution and increasing up to 1:1000, is often of marked benefit. The reaction following is rather severe, and may last five to six days, and should be allowed to subside before repetition. After the reactive symptoms have passed away, the pain of urination is lessened and the intervals between the acts are prolonged.

Guaiacol, with the addition of iodoform, suspended in olive oil, ½ ounce of which is injected every day into the bladder and allowed to remain in, often controls vesical tenesmus and pain, and enables the patient to hold his water for a longer time, and is one of the best applications for healing the ulcers after a nephrectomy:

| | | |
|---|---|---|
| ℞ | Guaiacol | gr. xxv |
| | Iodoform | gr. xij |
| | Olive oil | ℥j |

A watery suspension of orthoform, gr. viij to ℥ss, injected into the bladder and held there as long as possible, often relieves the pain for two or three hours.

Nitrate-of-silver instillations are irritating, and aggravate the inflammation. This is so notably the case that a violent reaction following the use of nitrate of silver in a case of cystitis suggests that it is tuberculous in orign.

Rovsing[1] has found carbolic acid to be the most efficient local measure for healing the ulcers. After nephrectomy he waits to see if spontaneous cure takes place (occurred in 14 cases, as shown by cystoscopic examination).

In the remaining 25 cases healing did not occur, but the tuberculosis extended, and on these the carbolic acid treatment was used.

The bladder is washed with sterile water and injected with warm 6 per cent carbolic acid solution, which is left in two to three minutes. It returns as a milky fluid. The procedure is repeated till the carbolic acid returns clear.

The improvement is rapid, the pus secretion ceases, and the urine becomes clear. The intervals between the washings are increased, as the cystoscope shows ulcers of the mucous membrane covered with smooth mother-of-pearl cicatrices. The time required is from six to eight weeks to effect healing. Two conditions are necessary for healing: first, the origin of the infection must be removed, and, secondly, the tuberculosis must be confined to the mucous membrane and not involve the bladder wall, and only under these conditions is it proper to apply the treatment.

The objection to the use of carbolic acid is the pain, which can be lessened by injecting novocaine or eucaine into the bladder, followed by an opium suppository or hypodermic of morphine.

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[1] Zeitschrift für Urologie, Band 3, Heft 4

Symptoms of çarbolic acid poisoning were rarely observed. Rovsing occasionally noted high-colored urine, fainting, and vomiting, but these unpleasant effects soon passed off. In the inoperable cases of bladder tuberculosis, as time goes by, the suffering increases in spite of all local treatment, and even opium in large doses fails to control the tenesmus and frequent urination.

**Permanent drainage of the bladder through a fistula** should be established. This is not successful in relieving the difficulty entirely, but it is the last resort for the relief of the intense suffering. The suprapubic opening is to be preferred, as the apparatus for receiving the urine can be more easily applied and the patient is not long confined to bed, but can be up and about.

At the time of operation the bladder may be inspected, and if a few isolated tubercular ulcers are found they can be removed with the curette or Paquelin cautery and iodoform rubbed into the spots.

The subsequent healing of the ulcers has a favorable influence upon the pain and tenesmus, and the permanent fistula in the bladder affords an opportunity for the complete and painless evacuation of ammoniacal urine and pus, and also admits of its cavity being kept clean by irrigations, and the congested mucous membrane can also be medicated by instillations of corrosive sublimate or nitrate of silver.

When the bladder cavity is very much contracted and its walls are thick and rigid, suprapubic cystotomy can not be so readily performed, and permanent drainage through a fistula in the perineum has to be resorted to.

There is always the danger, in establishing an artificial fistula, that the wound itself may be infected and become the seat of a tuberculous infiltration, increasing the extent and rapidity of the progress of the disease. The perineal wound is much more liable to infection than the suprapubic opening, and should only be used when the suprapubic fistula is impracticable.

Tuberculin as a therapeutic measure may be mentioned, but the experiences are too insufficient at present to give any decided opinion as to its usefulness.

## DIVERTICULUM OF THE BLADDER

The condition of diverticulum of the bladder is not so rare as was formerly supposed. It consists of one or more saccular dilatations which communicate freely with the interior of the bladder and may contain a few ounces or a pint or more of urine.

The etiology is obscure. By many authorities it is supposed to be a congenital defect and by others it is considered an acquired deformity due to obstruction at the vesical outlet. The additional force required to empty the bladder causes a hypertrophy of the muscular fibers and the bladder wall gives way between the muscular fibers, allowing the serous coat covering the bladder to become distended and form a saccular dilatation.

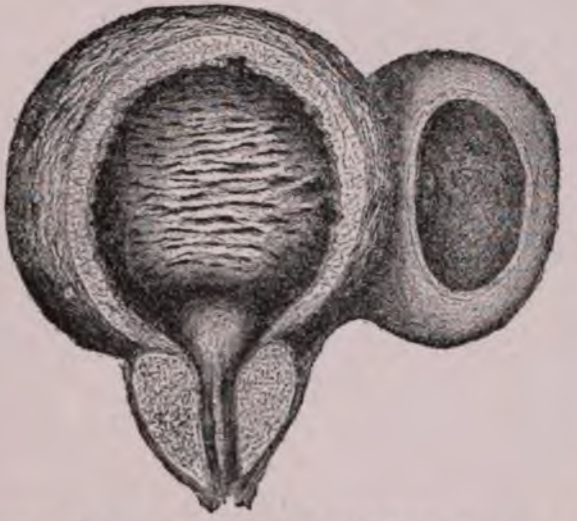


Fig. 155.—Formation of a sacculation in a hypertrophied bladder from prostatic enlargement and prolonged cystitis.

### Symptoms

The symptoms are not very characteristic and consist in frequent urination, sometimes difficult urination, with the urine containing large amounts of pus.

A suggestive point in the diagnosis consists in the patient's noticing a sudden filling of the bladder after he has just voided. The passage of a catheter into the bladder will not result in the withdrawal of much urine after the patient has voided, unless the sac has been entered, when a large quantity will be withdrawn.

A symptom which is of some importance is the **passage of clear** urine followed by a considerable quantity of urine **containing large** amounts of pus.

In the course of time the interior of the sac **becomes infected** and then the urine, which before had been clear, becomes **heavily** loaded with pus, ammoniacal and intensely fetid.

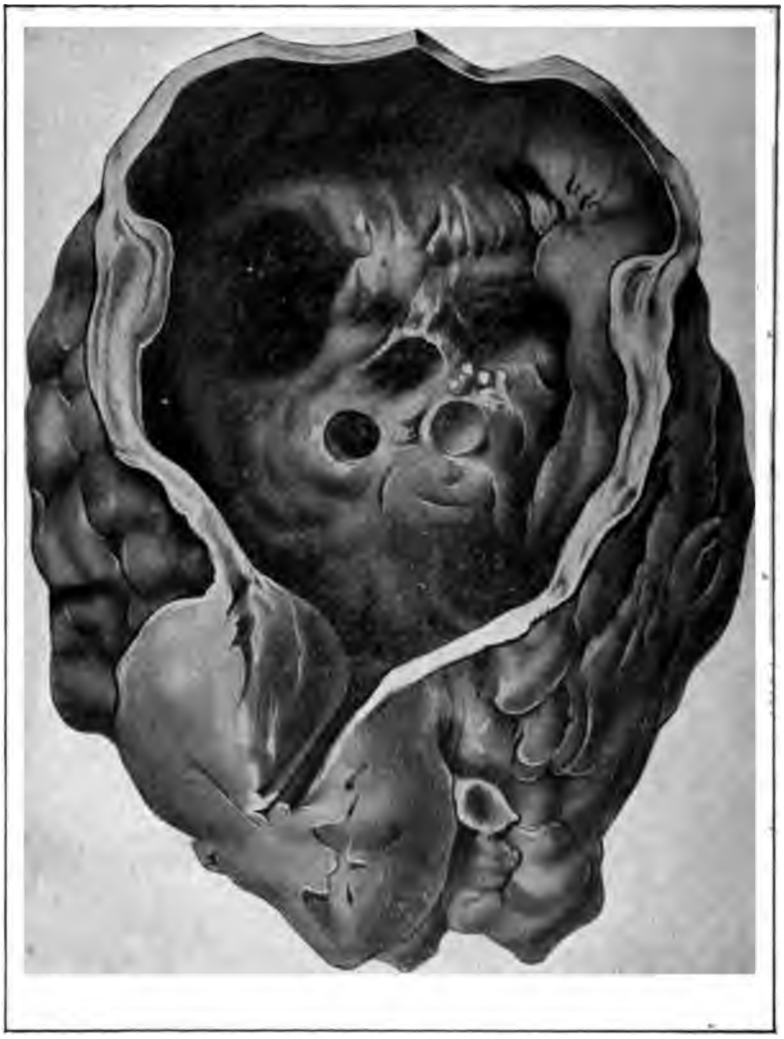


Fig. 156.—Multiple saccular diverticula of bladder.

The consequences of saccular dilatation are the formation of a calculus within the dilatation and, ultimately, ascending infection of the kidneys with pyelitis, pyelonephrosis and ultimate death from urosepsis.

## Diagnosis

A saccular dilatation may be suspected in the presence of an inveterate cystitis which is not influenced by treatment. Palpation, after the bladder has been emptied with a catheter, may disclose a fluctuating tumor in the bladder region which feels like a bladder filled with urine. If the bladder is emptied with a catheter and several ounces of fluid injected and the patient voids considerably more fluid than was injected, the presence of a diverticulum may be suspected, but by means of the cystoscope the diagnosis is readily made, for the opening of the saccular dilatation may be readily seen as a black spot.

Many cases are so situated that the depth of the dilatation can only be ascertained by passing a ureteral catheter into it.

The radiogram is of great assistance in confirming the diagnosis. The bladder should be filled with collargol or argyrol and in the radiographic picture the shadow of the diverticulum may be easily seen. When the diverticulum is located in the posterior portion of the bladder, the radiogram must be taken laterally in order to bring the diverticulum into view.

## Treatment

Palliative treatment of this condition of bladder by washing and urinary antiseptics is of very little use, for it is almost impossible to empty the sac of its contained urine, and the only recourse is to remove the sac by surgical operation. This may be done according to the technic of Lower and Cabot, as follows:

With the bladder filled with water and the patient in the Trendelenburg position, a transverse incision is made through the skin and fascia and the bladder exposed. The peritoneum should be stripped back before the bladder is opened, and if the peritoneum can be pushed back sufficiently far to expose the sac, the operation can be done extraperitoneally with but little risk to the patient. If it is found impossible to strip back the peritoneum sufficiently far, it is better to incise it freely and protect the peritoneal cavity by gauze packing. The bladder should be next opened, the fluid evacuated and with the finger search made for the opening in the diverticulum. It facilitates handling of the diverticulum very much if its cavity is packed with gauze strips before any attempt at dissection is made. When the cavity of the diverticulum is distended with gauze, the external surface of the diverticulum should be grasped with volsella and the diverticulum removed from the bladder by free dissection. The opening in the bladder should then be closed with two layers of catgut suture. If the diverticulum is in the neighborhood of the ureter, provision should be made for the reimplantation of the ureter into the upper portion of the bladder. The location of the ureter at the time of operation may be facilitated by the previous passage of a ureter catheter before the operation is begun. The ureter having been reimplanted when necessary, the incision in the anterior surface of the bladder may be closed with sutures, a drain placed in the space of Retzius and the skin and fascia united. The operation is completed by the introduction of a permanent catheter; which remains in place, draining the bladder, for at least ten days. It is better to avoid any subsequent bladder washing for fear of distending the bladder and breaking out the stitches.

### BIBLIOGRAPHY

Cabot: Boston Med. and Surg. Jour., Feb. 25, 1915.
Lower: Jour. Am. Med. Assn., Dec. 5, 1914; International Clinics, iv, series 26.

# CHAPTER XXII

## TUMORS OF THE BLADDER

The causation of bladder tumors is unknown, although from their frequent occurrence in aniline dye workers it would seem as though a chronic irritation of the bladder acted as a predisposing cause.

They are more common in men than in women, and usually appear between the ages of 30 and 40, at which time they are more apt to be benign. After 40 they are usually malignant.

From a clinical standpoint bladder tumors may be divided into two groups: *benign papilloma and carcinoma,* although the classification can not always be rigidly adhered to on account of the tendency of the benign growths to be transformed into cancer.

Other forms of tumors, fibroma, myoma, sarcoma, and myxoma, are very rare but may be found two or three times in a series of 100 cases.

**Papilloma** may be single or multiple and attached to the bladder wall by a pedicle or with a broad, sessile base. It is most commonly met with as a number of tumors growing from a common pedicle, like the branches of a tree from its trunk.

The villi are composed of a fine stroma of connective tissue containing a loop of vessels and covered with several layers of epithelium. When dry the villi collapse, but in fluid they unfold and float in waving strings. These papillomata may be single, but in 30 to 40 per cent of the cases (Albarran) they are multiple.

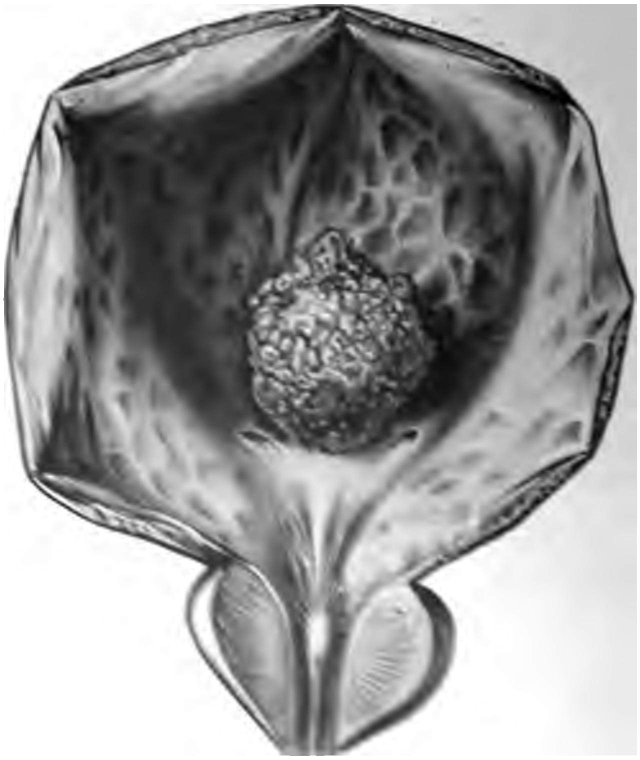
In the large majority of cases they are located on the posterior lateral wall of the bladder, above and to the outer side of one ureter. The pedicle when drawn on is found to be composed of mucous membrane and blood vessels, and is thin and often translucent.

The thinness and translucency are clinical signs that the tumor is benign, although the diagnosis can be made positively only by a microscopic examination of the underlying base of the tumor.

It is well established today that a tumor which was originally benign, if allowed to remain without being operated on, becomes transformed into a carcinoma, and even if a benign tumor is removed surgically if a recurrence takes place the second growth is very likely to be a cancer, instead of the original type of benign papilloma.

## CARCINOMA OF THE BLADDER

Carcinoma of the bladder is of more frequent occurrence than the benign papilloma. It may be pedunculated, but is usually seated on a broad base which infiltrates the surrounding tissues.



This type is very malignant and consists of epithelial cells lying in a delicate connective tissue stroma, which projects into the cavity of the bladder, and also invades the connective tissue spaces and lymphatics of its wall.

(*b*) An epitheliomatous ulcer which lies upon the wall of the bladder. The ulcer is small and shows a raised edge surrounding a friable floor covered with phosphatic *débris;* the base is dense and hard. In 70 per cent of the cases the ulcer is located in the lower third of the bladder and soon involves the trigone.

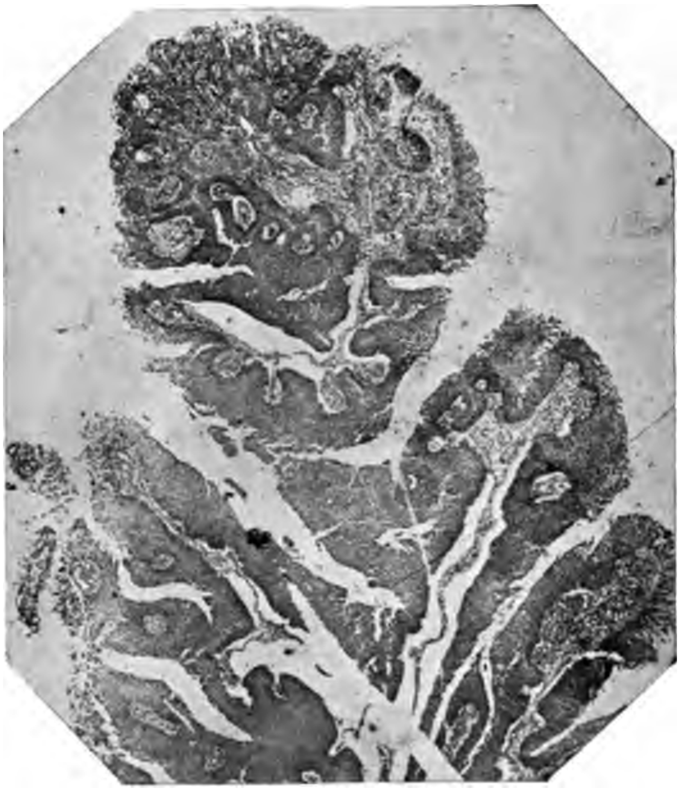


Fig. 158.—Benign bladder tumor. Clipping removed by intravesical operation.

## Mode of Extension

All bladder tumors, both benign and malignant, may extend to other parts of the bladder by *contact inoculation.*

New growths appear on the bladder wall at different points which are in contact with the original tumor when the bladder is empty, or a recurrence after operation occurs in the cicatrix in the bladder or suprapubic wound, and is due to transplantation of a few cancer cells at the time of operation.

Carcinomata spread by infiltrating the surrounding tissues, or the cancer cells are carried through the lymphatic vessels to the iliac and subsequently the lumbar glands and metastases often occur in the bones and lungs.

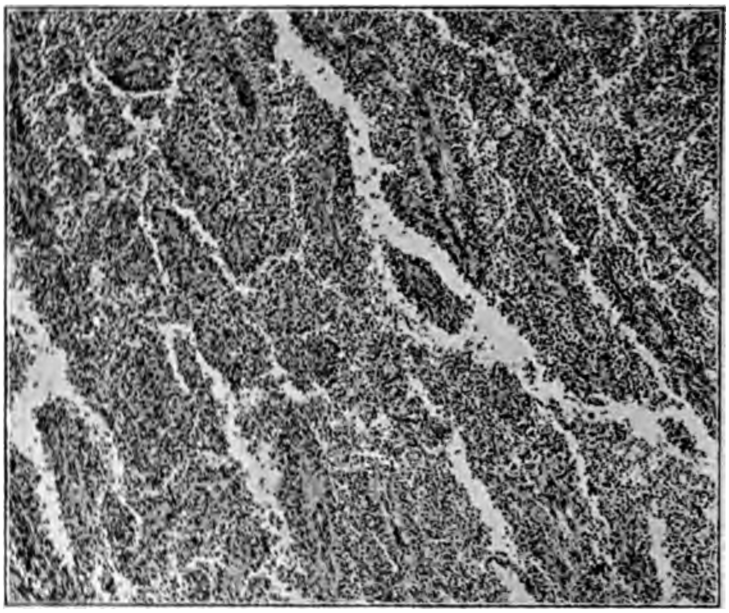


Fig. 159.--Carcinoma of bladder.

## Symptoms and Course

In the beginning there is but little difference in the symptoms between benign and malignant tumors. The most prominent symptom is **hematuria**, which may last for years, gradually increasing in quantity and causing the patient to become markedly anemic and cachectic in appearance.

The hemorrhage comes on suddenly and without provocation, and may last a few hours or some weeks and then cease, and the urine remains free from blood for a varying length of time, only to be followed by a recurrence of the hemorrhage. The quantity of blood lost is variable and fluctuating, but as the tumor grows larger more blood is lost.

In the early stages the bleeding may be confined to the loss of a few drops after urination, but later it becomes so profuse as to color the urine throughout, or even to form large clots, which cause great distress from the efforts of the bladder to expel them.

The nature of the tumors can not be determined by the severity of the hemorrhage, for simple polypi often bleed profusely, and a carcinoma may cause but very little hemorrhage.

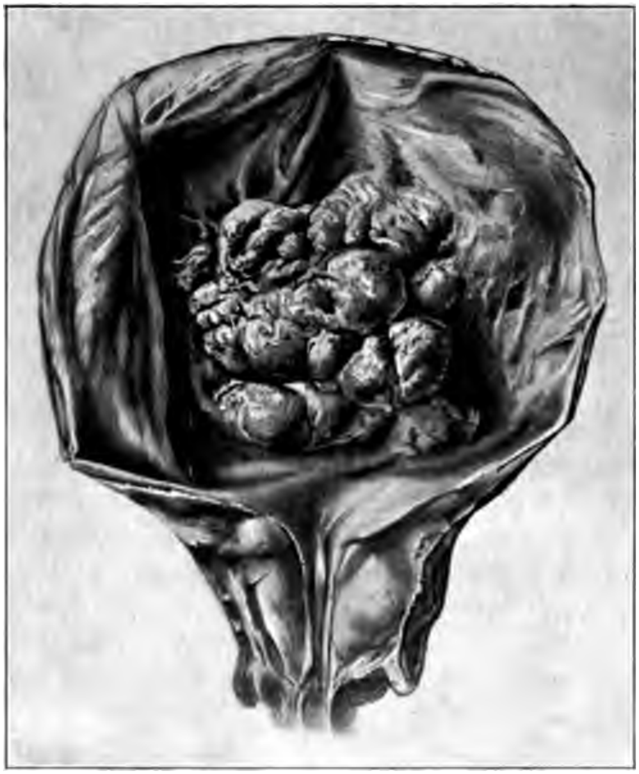


Fig. 160.—Carcinoma of bladder.

Caspar states that a tumor which bleeds constantly, hemorrhage being interrupted by the passage of a nonsanguinolent urine for a few days at a time, is nearly always malignant.

**Pain and Dysuria.**—Pain is a very inconstant symptom. When present in cases of benign papilloma it is due to the cystitis and becomes less as the cystitis improves under treatment.

The disturbances of urination also depend upon the cystitis, and improve or become less severe as the cystitis gets better.

In malignant cases pain may not be noticed until the case is far advanced. Here it is also due to the cystitis and the tenesmus and straining efforts of the bladder to rid itself of the urine.

Pain radiating along the thighs or referred to the anus and perineum is attributed to the pressure of the growth and its metastases upon the nerves supplying these regions.

The *presence of fragments of tissue in the urine* is of considerable diagnostic value, but frequently no pieces are passed.

When portions of the polypi are obtained for examination, the result may be misleading, as it is generally necessary to examine the base of the tumor microscopically to find the carcinomatous infiltration. If only the fimbriated extremities are examined they are found to be composed of loops of blood vessels, and are not characteristic of the nature of the growth.

**Course.**—Before the development of cystitis in a case of benign papilloma the only symptom which exists to denote the presence of a bladder tumor is the intermittent hematuria, and unless a cystoscopic examination is made the patient may go on for years with no discomfort. After cystitis is established, however, the quantity of blood lost increases, pain and tenesmus are distressing, interfering with the sleep at night; the anemia from the loss of blood becomes marked, and the patient rapidly grows weaker. If the tumor obstructs the orifice of a ureter or interferes with the outflow of urine from it, hydronephrosis of the corresponding kidney occurs, and is generally followed by infection converting it into a pyonephrosis.

If the tumor grows so large that it nearly fills the cavity of the bladder, a spontaneous breaking off and expulsion of the villi often occur to afford a temporary relief. In other cases the tumor grows so large that the bladder has insufficient room for holding urine, and the frequency of urination is increased, and as a result of increased contractions of the bladder the hemorrhages occur more often.

While a benign papilloma may remain a long time in the bladder without causing much discomfort, it is certain to cause the patient's death eventually, usually by degenerating and becoming transformed into carcinoma. If this does not take place the prolonged loss of blood or pyelonephritis from ascending infection from the bladder finally causes death.

Malignant tumors run a much more rapid course, the average uration of life being about three years after the onset of symptoms.

The amount of blood lost is less than in benign papillomata, but the attacks of bleeding are more frequent.

The prolonged loss of blood, the broken sleep from the frequent calls to urinate, together with the occurrence of metastases, combine to produce a general enfeeblement and cachexia, which cause death unless the kidney complications mentioned above hasten the fatal termination.

## Diagnosis

A painless hematuria should arouse the practitioner's suspicions at once, and, instead of being treated with drugs and delay, demands an early cystoscopy.

The cystoscope has achieved its greatest triumph in the diagnosis of bladder tumors, and in most cases by the use of an irrigating observation cystoscope an experienced observer can wash the bladder so clean that he can obtain a perfect view of its walls and cavity.

In exceptional cases the hemorrhage may be so free that even with an irrigating cystoscope a view can not be obtained. In such an event the examination must be deferred until the hemorrhage has ceased.

In making the cystoscopic examination, the observer should note the size of the tumor, its location, its shape, whether pedunculated or sessile, whether it presents villi, and whether more than one growth is present.

The presence of necrotic papillæ on an otherwise benign-looking papilloma, the presence of edema around the margin of the tumor or nodules in the mucous membrane in its neighborhood, the presence of an intractable cystitis are all points that indicate malignancy rather than a benign papilloma.

**Palpation** by means of one finger in the rectum or vagina and the other hand over the bladder sometimes discloses a tumor infiltrating the wall of the bladder; but if palpation proves negative, we can not be sure that a tumor is not present, for there may be one so small and superficial that it can not be felt.

Microscopic examination of a portion of the tumor excised through an operating cystoscope or fragments passed with the urine is very misleading in the differential diagnosis of benign and malignant tumors, for the histologic picture is very often the same in both instances.[1]

After the tumor has been excised at operation and a microscopic examination can be made of its base, one can arrive at a very correct opinion as to its malignancy.

Other conditions which may give rise to slight hematuria are congestion of the posterior urethra in young men as a result of venereal disease or sexual excesses. In old men it is not infrequently the result of a hypertrophied prostate, alone or complicated by a stone in the postprostatic pouch.

Hematuria may also originate from disease of the kidneys, and a cystoscopy with ureteral catheterization and a radiogram may disclose a renal calculus, hypernephroma, or tuberculosis of the kidney.

In women a urethral caruncle is a frequent cause of hematuria and is easily excluded.

## Treatment of Hemorrhage

The attempt to remove the tumors by palliative or symptomatic treatment is useless. The **hemorrhage** is sometimes profuse, but never dangerous to life, and usually yields to rest in bed, with an ice bag over the suprapubic region, light diet, and hydrastis, ergot, or stypticin internally.

One of the most important points in the management of these cases consists in placing a permanent catheter in the urethra and tying it in for several days.

This stops the muscular contractions and puts the bladder at rest, and drains away the blood while still fluid and before it has clotted. In this way the painful contractions of the bladder to force out the clots are avoided.

*Locally*, bladder washing with strong solutions of nitrate of silver is fairly reliable.

Three ounces of 1:1000 or 1:500 nitrate-of-silver solution are injected into the bladder every two days. An eschar is formed over the bleeding area and the vessels plugged. A larger quantity of fluid is not desirable, for it distends the bladder and separates its walls. L. B. Bangs recommends injecting two ounces of creolin solution, $\frac{1}{4}$ to $\frac{1}{2}$ per cent, which is retained in the bladder from twenty to thirty minutes, and used daily at first and later every second day.

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[1] Geraghty: New York Med. Jour., Oct. 28, 1916.

Merck's solution of gelatin, 2 per cent, injected into the bladder and retained, is sometimes useful in stopping the hemorrhage.

In this way hemorrhage from simple papilloma is always controlled and usually also from malignant disease.

The evacuation of clots is sometimes troublesome, although if of moderate size they soften and pass naturally, but if the bladder becomes greatly distended by clots and urine they may be broken up and washed out through a large catheter, by injecting one or two drams of peroxide of hydrogen through the catheter. This causes a disintegration of the clot, which can be washed out with very hot salt solution and a large syringe, or the clots may be broken up and drawn off by means of a litholapaxy-evacuating tube and aspirator. Sudden distention of the bladder with the fluid should be avoided, for it is liable to cause the bleeding to recommence.

If the bleeding is uncontrollable a suprapubic cystotomy is the last resource for the purpose of evacuating the clots and removing surgically a papilloma or cauterizing the bleeding spots with the Paquelin cautery.

## Treatment of Tumors of the Bladder

As every bladder tumor causes death eventually, the benign tumor through exhaustion from repeated hemorrhage or pyelonephritis, and the malignant tumor from metastasis or cachexia, it is essential to remove the tumor surgically, if possible, as soon as the diagnosis is made.

The status of the treatment of benign papillomata is today fairly well settled among urologists, and the choice of procedure rests between fulguration and excision through a suprapubic cystotomy.

**Fulguration.**—Fulguration had been previously used in the treatment of cancer in other regions, but it was first applied in the treatment of bladder tumors by Beer, of Mount Sinai Hospital, three or four years ago. Fulguration of bladder tumors consists in the application of a high frequency current of great activity, either the Oudin or D'Arsonval, by means of a copper electrode insulated with rubber and carried into the bladder through an ordinary catheterizing cystoscope. As a matter of experiment, the effects of the current can be shown by using a piece of raw meat and introducing the needle into its substance. The effect of the application of the current is to char or cauterize the meat around the point of the electrode, and the same effect is obtained in the bladder when the point of the electrode is pressed into the substance of the tumor. In observing the effects of the high frequency current through the cystoscope we note that at first the tumor becomes blanched around the area where the wire is placed and bubbles of hydrogen gas can be seen coming up through the water which fills the bladder. After that particular part has been charred long enough, for from 30 to 60 seconds, the point is removed and inserted into another portion of the tumor. The process of fulguration is continued as long as the patient is able to stand it, or until the fluid gets so bloody that one can no longer see where the electrode should be placed. After a sitting is finished the tumor presents a blanched appearance with a number of black spots around it corresponding to the places where it has been burned.

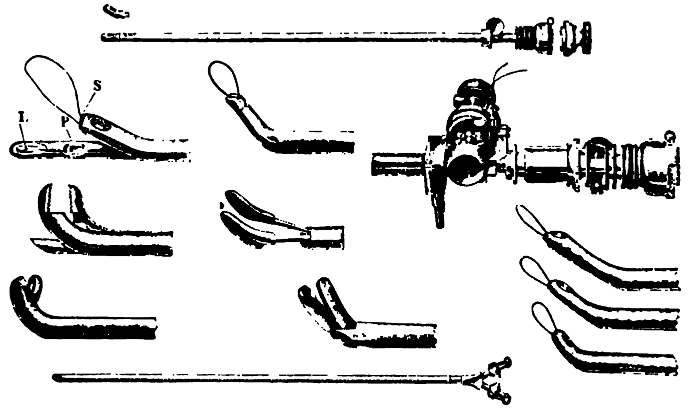

Fig. 161.—Operating cystoscope of Nitze.

Fulguration may be applied to tumors at weekly intervals, and by this means it is possible to burn out fair-sized tumors, not very large ones, and benign papillomata may be entirely disposed of in this way.

The cases which are best adapted to fulguration are benign papillomata of the small variety, either single or multiple, if there are not too many.

In carcinoma of the bladder fulguration may be tried, but it is not so successful as in benign papilloma. Fulguration may, however, always be tried even in cases of carcinoma, and it is more useful in malignant cases if applied after the thorough use of radium.

There are certain contraindications to the use of fulguration as laid down by Beer:

1. In the case of patients who are intolerant to the use of instruments.

2. In those cases of tumor where the bleeding is very profuse, and where by reason of the fact that it is impossible to see what is being done, the fulgurating wire can not be used.

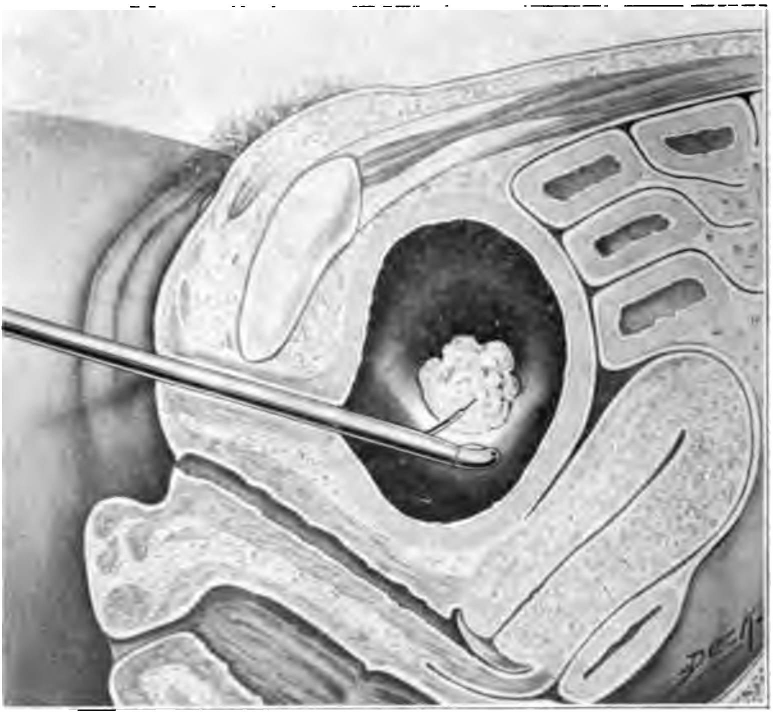

Fig. 162.—Showing destruction of tumor in bladder by fulguration with the high frequency current.

3. Those cases where the location of the tumor is such that it is out of reach of the fulgurating wire; and,

4. Cases of a general papillomatosis of the bladder from reimplantation, and where there are multiple tumors scattered throughout the bladder.

The method of fulguration has entirely supplanted the treatment devised by Nitze of the intravesical removal of papillomata by means of his operating cystoscope. Few attained the degree of skill in the use of this instrument which Nitze possessed, and the method was only adapted to papillomata which could be encircled by the sling of his cystoscope and removed by this means.

**Excision of Papilloma by Suprapubic Cystotomy.**—It was formerly the custom to remove bladder tumors by a perineal incision into the bladder, grasping the projecting tumor with forceps and roughly tearing it off. Although projecting parts of the tumor could be removed in this way, yet its base was left, and if the tumor was an infiltrating carcinoma, after such interference it would grow more rapidly than if left alone. Even benign papillomata treated in this way were nearly always followed by recurrences, either because the mucous membrane at the base of the tumor was not removed, or because some of the cells of the tumor were transplanted into other parts of the bladder at the time of operation.

At the present time the requirements for an operation are not only to remove the tumor and also the mucous membrane forming its base, but during the operation to avoid brushing off portions of the tumor which may be implanted on other parts of the wall.

A single benign papilloma with a long pedicle presents an ideal case for removal by suprapubic cystotomy. The tumor may be grasped with ring forceps, drawn tense and its pedicle burned through with a Paquelin cautery. After removal of the tumor the tissues at its base should be thoroughly seared with the Paquelin, or the pedicle may be drawn tense with forceps and a half-inch of the surrounding mucous membrane excised with scissors. In order to avoid brushing off the cells during the operation it has been suggested that the surface of the tumor be thoroughly charred or burned with the Paquelin cautery before any attempt at removal is made. A simpler method, however, is to fill the bladder with 95 per cent alcohol with a view of destroying the vitality of any cells which have been accidentally brushed off during the manipulation.

To obtain a free exposure of the bladder during these manipulations, it is usually better to make a transverse incision through skin and fascia, and in certain cases it is necessary to partially divide transversely the recti muscles with scissors close to their attachments to the pubis. The bladder should be tightly closed with two layers of catgut sutures, one through the muscular coat and a Lembert through the serous coats. The divided ends of the recti should be united and the abdominal wound closed with a gauze drain in the space of Retzius and the bladder drained with a Pezzer catheter.

Every patient who is operated on for benign papilloma of the bladder should be treated subsequently by bladder irrigations with a resorcin solution, beginning four or five weeks after the wound is healed. A 1 per cent solution should be used at first and in the course of several months the strength increased to 5 per cent. Irrigations should be made twice a week. It is said that in this way recurrences can be very largely prevented.

### Treatment of Carcinoma

It is today a debatable question among genitourinary surgeons as to whether it is advisable to subject carcinoma of the bladder to a cutting operation immediately or to try palliative measures with fulguration and radium and defer operation until the dysuria and tenesmus cause such distressing symptoms as to require a suprapubic fistula or a double nephrostomy merely for the relief of symptoms. Five or ten years from the present time we may have standardized our procedures to such an extent that we will know exactly what to do, but now we must depend upon the size, character, location of the growth, in cancer of the bladder, together with the age of the patient, the state of the kidneys and various circumstances which enter into a case.

As to the former procedures in these cases: surgeons, for want of a better method, would open the bladder, twist off the growth with forceps and perhaps lightly cauterize as freely as possible with a Paquelin cautery. These rough operations frequently resulted in urosepsis and the speedy death of the patient, and if this did not occur there would always be a recurrence. An improvement over this method consisted in incising the mucous membrane at the base of the tumor and removing a considerable portion of the mucous membrane with the tumor. It was, however, impossible to remove all the cancerous growth in this way and metastases would occur later in other organs. The incision and manipulation seemed to stimulate the growth of the carcinoma, the fistulous opening in the bladder frequently failed to heal and the patient was always wet and sloppy from the constant drainage of urine.

Subsequently, because of the hopeless character of cancer of the bladder, even more radical operations were attempted until in very recent times complete excision of the growth and the entire bladder wall involved has been practiced, and even complete cystectomy (entire removal of the bladder) has been done.

The approach to growths located in the lower part of the bladder is facilitated by using the transperitoneal approach as suggested by the Mayos, in that way approaching the bladder from behind so the whole bladder wall may be excised. In order to be successful, however, such an extensive operation as this must be undertaken early when it is possible to do a complete removal of the whole bladder area involved.

As these tumors generally exist low down in the trigonal region, one ureter, and sometimes both, must be cut through and transplanted in some other part of the bladder wall.

The contraindications to any radical operation in the presence of carcinoma of the bladder, have been classified by Geraghty as follows:

1. When the infiltration is close to the vesical orifice and the prostate is involved.

2. When the infiltration is so extensive that it is necessary to transplant both ureters. Then no operation should be done.

3. When multiple tumors are present, unless the entire area can be excised.

[illegible] upper and [illegible] and a [illegible] is a fair [illegible] operation [illegible] at [illegible]

[illegible]

without operation than they do with operation. Conservative men feel that operation is only justified in:

A. Neoplasms involving the dome or front of the bladder.

B. Neoplasms at the neck of the bladder, like the stopper in the neck of a bottle, which cause retention. A patient with such a condition as this suffers all the time. He has back pressure on the ureters and kidneys, with retention of urine. He suffers intensely from tenesmus and straining, and in these cases it is proper to open the bladder above the pubis and remove the obstruction and provide drainage for the bladder.

C. Cases where the hematuria is so excessive as to make intervention necessary, where the patient is rapidly becoming anemic and liable to die unless something is done for him. Here it is proper to open the bladder and make an effort to check the hemorrhage, either by removing a bleeding tumor or cauterizing the bleeding point with a Paquelin.

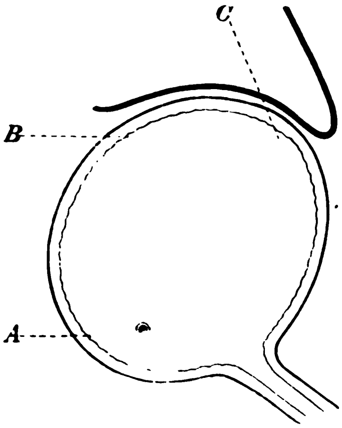

Fig. 163.—Diagrammatic representation of bladder and peritoneal fold. A tumor located between *C* and *B* can be readily excised together with a portion of the bladder wall. A tumor located near *A* is excised with difficulty requiring approach by the transvesical route and reimplantation of one or both ureters.

## Radium

In cases of inoperable cancer of the bladder attention has lately been called to the effects of radium, and this method of treatment seems to offer more in the way of relieving the patient and prolonging his life than the radical operations. A drawback to the general use of radium lies in the fact that it requires a very large investment of capital in order to buy a sufficient quantity to be of any use, so that it is necessarily restricted to institutions rich enough to buy all the radium that they need.

While radium can hardly be said to be curative, its use seems to delay the progress of the growth and check the hemorrhages.

Fulguration, when used independently, is of little effect in improving bladder cancers, but when used after the free application of radium, its effect is notable.

Radium may be applied externally over the abdomen, or in the rectum, but the best method has been found to be at Johns Hopkins in applying it directly to the cancerous growth within the bladder on an instrument resembling the cystoscope. The radium is left in contact with the bladder growth for a number of hours and after repeated applications the treatment is continued by means of fulguration with the high frequency current.

At the present time the use of radium combined with subsequent fulguration, seems to offer more in inoperable bladder cancers than anything else which has yet been found.

## Palliative Operations

In the final stages of inoperable cancer the bleeding and retention of clots cause a great deal of tenesmus and straining of the bladder, there is great pain, the patient passes a small quantity of water every few minutes, and he suffers from exhaustion and want of sleep. He loses weight and strength from his cachexia and bleeding and these patients are pitiable objects. Such cases are relieved to a certain extent by morphine or opium until finally the time comes when morphine no longer relieves the distress. Then it is proper to make a suprapubic opening to drain the bladder for the purpose of stopping the terrible tenesmus and frequent urination. With a suprapubic fistula the patient can pass his few remaining months in this world with comparative comfort to himself. Instead of doing a suprapubic cystotomy, a double nephrostomy may be done, bringing both ureters out on the back, and instead of the urine flowing through the suprapubic opening, it may be passed into a receptacle carried on the back (F. S. Watson).

The important point, however, for the general practitioner to remember in cases of bladder tumors is that every hematuria calls for a cystoscopic examination for the purpose of arriving at an early diagnosis, and he should also bear in mind that prompt operation may be the means of saving the life of the patient. If this pretion be neglected, the bladder becomes so extensively involved t it is too late for operation and the life of the patient is sacri-d through the negligence or indifference of the physician whom first consulted by failing to insist upon a cystoscopic examina-n to discover the source of the bleeding.

## BIBLIOGRAPHY

**er, Edwin:** Ann. Surg., Aug., 1911; Jour. Am. Med. Assn., Nov. 16, 1912; Med. Rec., New York, Feb. 8, 1913.
**te, Arthur L.:** Jour. Am. Med. Assn., Dec. 26, 1914.
**ghty, J. T.:** New York Med. Jour., Oct. 28, 1916; Jour. Am. Med. Assn., Oct. 20, 1917.
**thbun, N. P.:** Long Island Med. Jour., April, 1917.
**mas, B. A.:** Surg., Gynec. and Obst., April, 1912.
**ng, Hugh:** Radium, June, 1917.

# CHAPTER XXIII

# VESICAL CALCULUS

The stones which are formed in the bladder are classified, according to their composition, into three varieties:

(*a*) **Uratic calculi,** which are made up of uric acid and urates. They form about three-fifths of the total number of calculi, and are the softest of any in their consistence.

(*b*) **Oxalic calculi** are composed of oxalate of lime. They occur less frequently than the others, the estimated proportion being about 3 per cent. They are the hardest and heaviest of all the varieties, and are usually studded with numerous projecting nodules, from which they derive the name of **mulberry calculi.**

(*c*) **Phosphatic calculi** are formed from phosphates and carbonates, which are often combined with urate of ammonia. Phosphatic stones are not so hard as the oxalic, but harder than the uratic stones. They are never due to constitutional or diathetic conditions, but are always the result of cystitis and decomposing urine, from which the salts are deposited and agglutinated together by the pus.

Stones composed of a single element alone are rarely met with. As a rule, two or more elements are found together, arranged in concentric layers around the nucleus.

The formation of a calculus is not a simple process of a deposit of salts, and it is a common occurrence for urine to contain crystals of uric acid, oxalates, or phosphates for a long time without the formation of a stone; but in the presence of albuminoid material these crystals change their molecular form, gain a tendency to coalesce and adhere to each other; also to a sort of framework composed of colloid material, which is furnished by the pus.

The practical deduction to be drawn from this fact is that, while crystals may be present in the urine for years without the formation of a stone, a cystitis producing pus gives the necessary stimulus to coalescence, and a stone is very likely to form.

## Number

Stones are usually single, although very frequently they are multiple; sometimes five or six may be present, and instances are

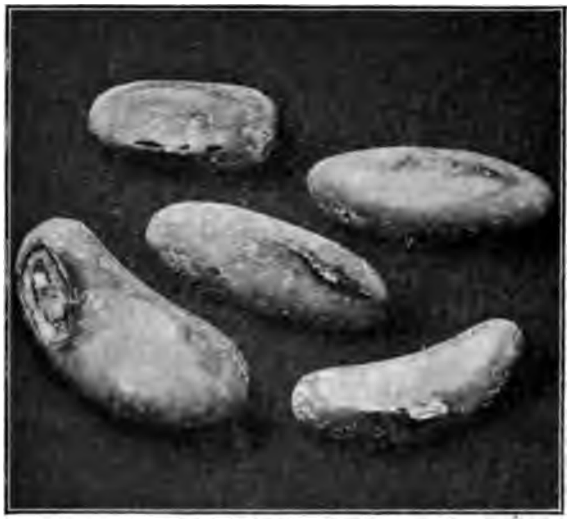

Fig. 164.—Multiple phosphatic calculi. Suprapubic cystotomy. (Author's case.)

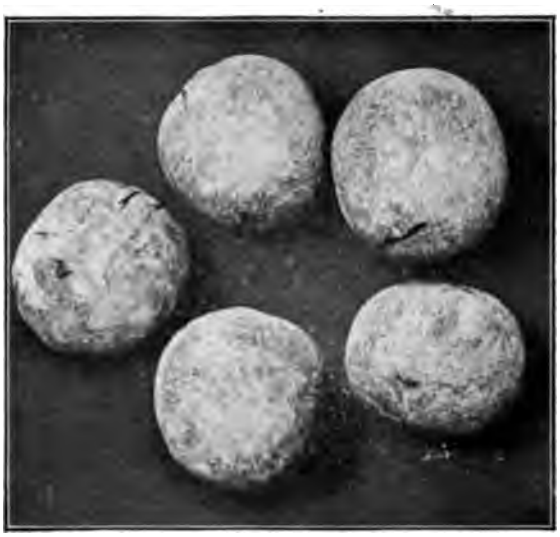

Fig. 165.—Multiple phosphatic calculi, complicating hypertrophied prostate. Suprapubic cystotomy and prostatectomy. (Author's case.)

on record where three or four hundred stones were taken from the bladder.

It occasionally happens that a single stone becomes multiple through a process of **spontaneous fracture.**

It has been found in laboratory experiments that, if a calculus formed in a solution of gum were placed in a solution of a d ferent specific gravity, it would split up into segments. Hence is probable that the instances reported of the spontaneous fractı of stones in the bladder, which have been accredited to differ mineral or spring waters, is due to the effect produced upon stone by surrounding it with urine whose specific gravity a reaction have been changed from their original state at the ti of formation of the stone by the ingestion of large quantities

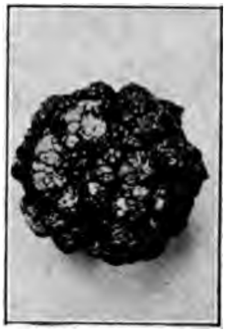

Fig. 166.—Mulberry calculus, removed by suprapubic cystotomy. (Author's case.)

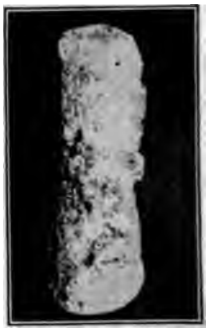

Fig. 167.—Glass bottle covered with crustations, removed by perineal section f a male bladder. (Author's case.)

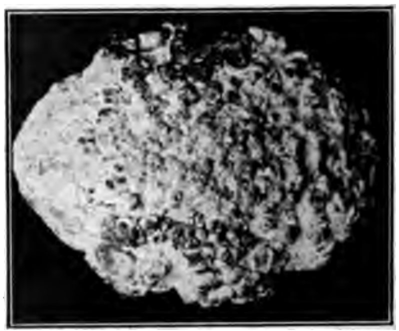

Fig. 168.—Mulberry calculus, removed from boy of 16 years. (Author's case.)

water. The albuminoid material forming the framework of stone absorbs fluid and swells, bursting apart the laminæ of stone and so fracturing it into segments.

## Etiology

For a calculus to form, it is absolutely essential that th should be a foreign body in the bladder, since the crystals m have a *nucleus* around which they may coalesce and adhere.

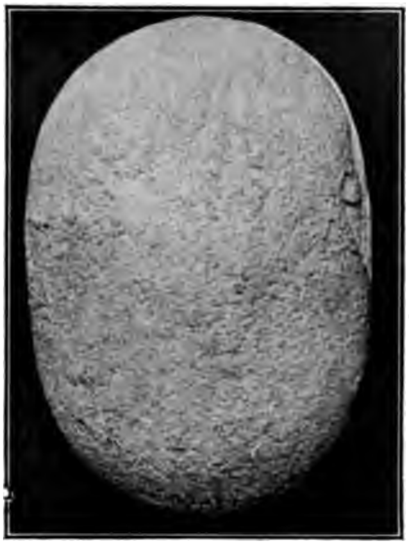

Fig. 169.—Vesical calculus. Weight, 1370 grains. Suprapubic cystotomy. (Author's case.)

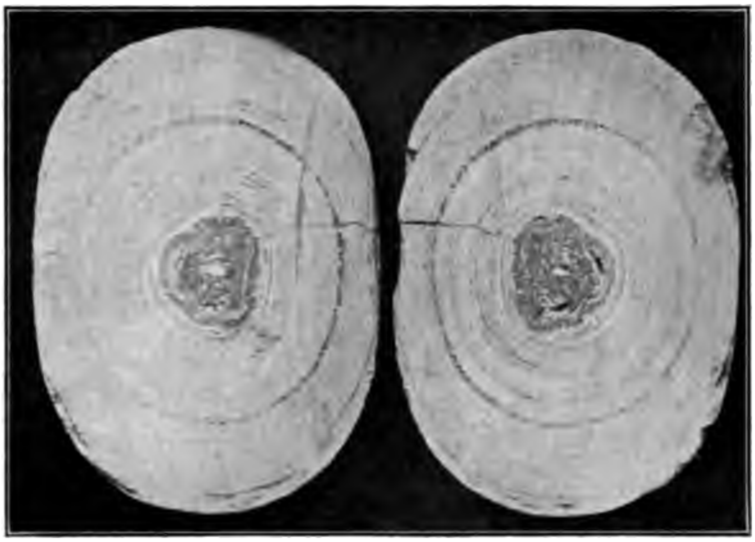

Fig. 170.—Same split in halves, showing mode of formation by a deposit of phosphates in concentric layers around a uric acid nucleus. (Author's case.)

The nucleus may be a foreign body introduced from without, such as a broken catheter stem or pipestem, pin, etc., or it may be a small piece of necrotic tissue which has been sloughed off from the bladder wall.

In many cases of stone, however, the nucleus is composed of uratic crystals. These become agglomerated in the kidney and pass through the ureter, causing renal colic. They drop into the bladder, and, if they are not voided through the urethra, form a nucleus.

**Predisposing Causes of Uratic and Oxalic Calculi.**—As these stones are dependent upon a constitutional or diathetic state, certain things which influence the general condition of bodily health play an important role in their formation.

It has been generally supposed that the habitual drinking of water impregnated with the salts of lime was very apt to occasion vesical calculus. Investigations to determine this point show that the cases of calculus are not equally distributed through the limestone districts, and that they are just as common in the adjacent regions where the water is free from lime, and on these accounts the limestone theory has been abandoned.

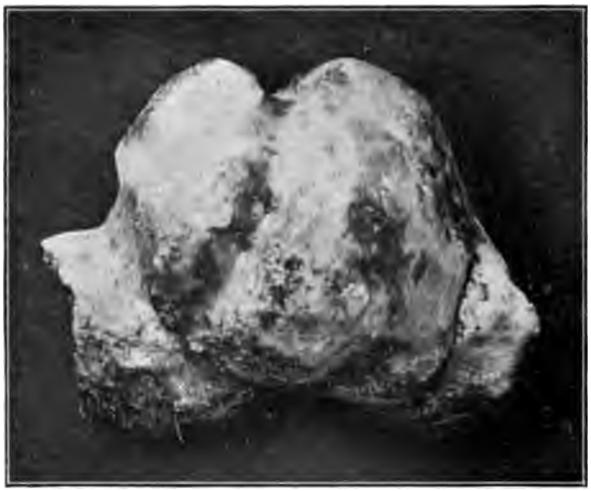

Fig. 171.—Vesical calculus, removed by suprapubic cystotomy. (Author's case.)

**Diet and constitutional habit,** however, are important factors in the production of stone, since the excretion of uric and oxalic acids depends upon the quality of the food and the diathesis. On this account children with feeble digestive powers, who eat largely of nitrogenous food, are unable to perform the processes of oxidation completely, and the results of the retrograde metamorphosis of the tissues are eliminated not as urea, which is freely soluble, but as urates or oxalates.

The same is also true of adults who eat more nitrogenous food than they require, use alcohol and malt liquors freely, and take but little exercise. Such persons are subject to attacks of gout or various manifestations of lithemia, which are included under the term of gouty diathesis.

The gouty diathesis is notably an inherited condition, and on that account different members of successive generations of a family are liable to develop oxalic or uratic stone in the bladder or some other gouty manifestation.

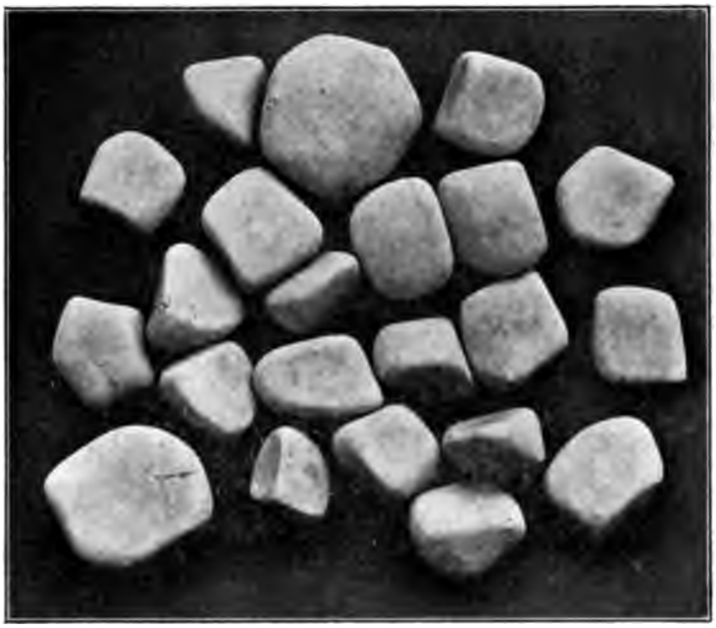

Fig. 172.—Multiple calculi of bladder, complicating hypertrophied prostate. Suprapubic cystotomy and prostatectomy. (Author's case.)

**Phosphatic stones** are not constitutional in their origin, but are dependent upon purely local causes. They result in consequence of urine decomposing and throwing down crystals of the triple phosphates, which are glued together by mucopus, and form nuclei, around which crystallization goes on rapidly.

On this account any obstruction which prevents the bladder from emptying itself—such as stricture, hypertrophied prostate, and paralysis—allows residual urine to accumulate, and, if cystitis occurs, alkaline fermentation of the urine, deposit of crystals, and stone formation result.

## Symptoms

While it is possible for a small stone to exist for years without producing marked symptoms, and particularly so if it lies in the pouch behind an enlarged prostate, it is usual for a stone in the bladder to give rise to the following prominent symptoms: (*a*) pain, (*b*) increased frequency of urination, (*c*) blood, and (*d*) sudden stoppage of urine in full stream.

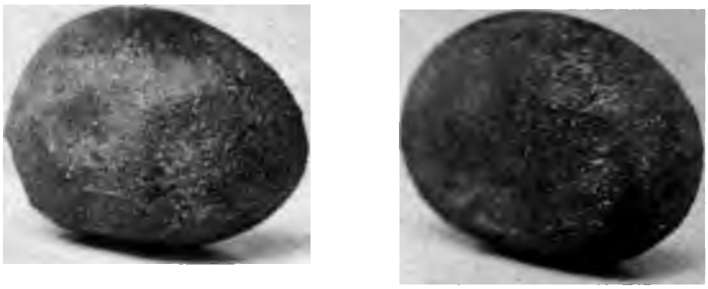

Fig. 173.—Two stones removed at one operation by suprapubic cystotomy. (Author's case.)

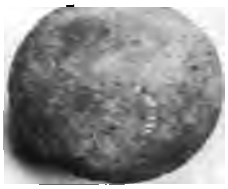

Fig. 174.—Vesical calculus removed by perineal cystotomy.

**The pain** is referred to the head of the penis under the glans, and shoots into the perineum and down the thighs.

It is felt especially at the end of urination, for, as the last few drops of urine are expelled, the muscular contractions of the bladder drive the stone forcibly into its neck, causing a contusion.

The pain is increased by riding in a jolting wagon, by going downstairs, or even by walking.

**Increased frequency of urination** occurs through the day, when the patient is about on his feet and the stone is moving in the bladder. At night, when the individual is quiet in bed, the stone does not move, and the intervals between urination are longer.

**Blood** never appears in any large quantity in the urine, but a few drops are squeezed out at the end of urination, or it may be mixed with urine, giving a smoky color. It is not a constant symptom, but intermittent.

**Sudden stoppage of the urine in full stream** is a very characteristic symptom, when it is present, and is caused by the stone being carried into the vesical outlet, obstructing it and shutting off the flow of urine like a valve.

It is rarely observed in old men with enlarged prostates, as the stone lies in the deep posterior prostatic pouch.

Cystitis always exists when a stone is present, and the symptoms of calculus are complicated by those of inflammation of the bladder.

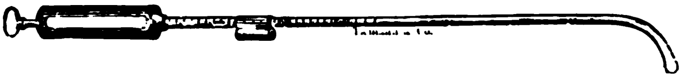

Fig. 175.—Thompson's searcher for vesical calculus.

## Diagnosis

The clinical history of stone is merely suggestive of the condition, but to make a positive diagnosis the stone must be touched with an instrument or through an incision in the bladder or seen with the cystoscope.

**Examination with Thompson's Searcher, or Sounding for Stone.**—The patient should lie on his back, and with old men it is desirable to elevate the hips so that the stone may roll out of the postprostatic pouch. The bladder should contain from four to six ounces of sterilized water, in order to distend its folds and allow the beak of the searcher to move freely.

The searcher is introduced after the manner of a sound, and the trigone and postprostatic pouch should be examined by turning the beak of the searcher from side to side and rotating it behind the prostate, as the stone always lies in the most dependent portion of the bladder.

If the stone is not touched, the fluid in the bladder should be allowed to flow out through the hollow shaft of the searcher, and, as the bladder collapses, the stone is often brought up against the point of the searcher and the impact can be felt.

There are certain precautions to be observed in sounding for stone. The patient's genitals should be cleansed and all the instruments must, of course, be sterile. Children should aways be examined under chloroform, as otherwise they would be restless, and the bladder might be wounded by a sudden movement.

In old men there is a great deal of danger of urinary fever. They should be examined at home and kept in bed from twenty-four to forty-eight hours after the examination. It is always desirable to administer salol, gr. v, t. i. d., or urotropin, gr. viiss, t. i. d., for two days before searching.

If there is a strong suspicion of the presence of a stone, it is advisable to make all the preparations for immediate operation, in order to avoid the reaction which so often follows an examination of the bladder.

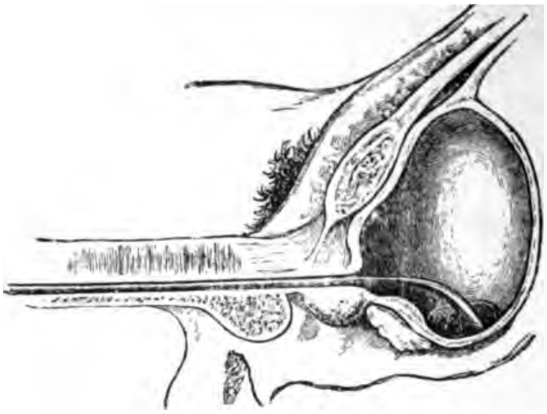

Fig. 176.—Searching for stone lying in the postprostatic pouch.

The presence of a stone is perceived by the searcher and gives rise to a sharp click, which can be felt and heard. Soft stones give a dull or muffled sound when touched, but the sound is sharper in character when a hard stone is struck.

The size of the stone may be measured by grasping it between the jaws of a lithotrite; but the determination of the *size* or ***number*** of the stones is difficult with the searcher, and for this purpose the **cystoscope** is of great value.

With this instrument it is possible to see the stones distinctly, unless the bladder is bleeding freely, and their size, shape, and location can all be accurately ascertained.

Phosphatic stones are white and round; uratic stones are yellowish and oval; oxalic concretions are dark and covered with bosses and sharp points; but it should be remembered that most stones are composed of different elements arranged in concentric layers. At the same time the position of the stone may be ascertained, for a stone lying in a deep pouch behind an enlarged prostate, or attached to the bladder wall as an incrustation, or lying in a saccular dilatation will often be out of reach of a searcher, and may be overlooked.

An examination of the urine often throws light on the character of the stone by revealing the predominant form of the urinary crystals.

**The litholapaxy pump** is sometimes useful in detecting a small stone which eludes the searcher. The tube is introduced and water forced into the bladder with the bulb. The outflow of the water forces the stone against the orifice of the tube, and the click is appreciable to the ear and to the touch.

The examination by the x-ray of a stone in the bladder will give a shadow on the plate, but the cystoscope is so much to be preferred that the x-ray examination is rarely necessary.

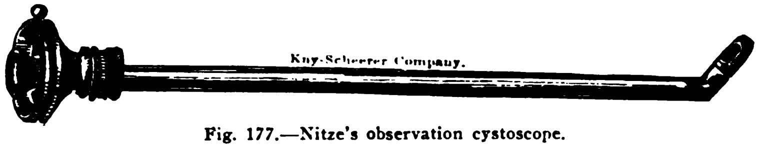

Fig. 177.—Nitze's observation cystoscope.

Since the introduction of the cystoscope into practice the **exploration of the bladder through a suprapubic or perineal wound** is rarely called for.

In former times it was often necessary in doubtful cases, particularly in the instance of a calculus lying in a saccular dilatation or in the presence of an incrustation of the bladder wall with urinary crystals.

## Preventive Treatment

The presence of crystals in freshly voided urine which is still warm should be regarded as an indication that calculus is liable to form, and the tendency to the formation of *uratic and oxalic stones* should be guarded against by attention to the patient's general health. He should be cautioned against using an excess of nitrogenous food, sugar, or fat. It is in general thought best not to cut off all nitrogenous food, but to allow a general diet, with a reduction of the accustomed quantity of meat.

Moderate and systematic daily exercise in the open air is o great assistance in favoring oxidation.

The ingestion of large quantities of pure spring or distille water has the effect of diluting concentrated urine, rendering so uble its contained salts, and flushing out the kidneys.

If the urine is strongly acid, citrate of potassium is indicated i order to render it neutral.

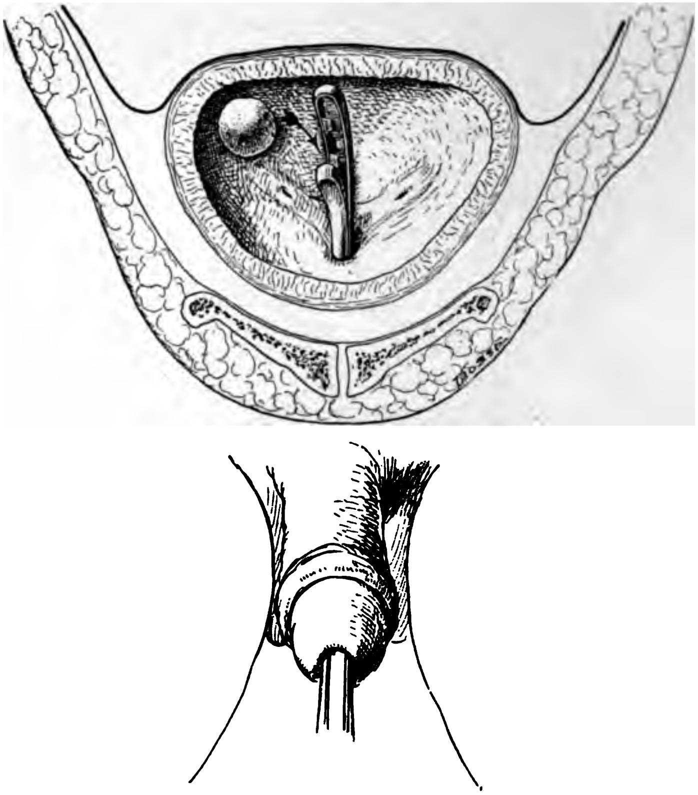

Fig. 178.—The lithotrite is opened in the median region of the bladder, and the calculus rolls between its jaws.

If phosphates are abundant and due to imperfect assimilation, the mineral acids, particularly phosphoric, in doses of ♏xv three times a day, and the vegetable bitters improve the digestive powers. The phosphaturia often disappears for a time and sometimes permanently under the use of urotropin, gr. viij three times a day, or benzoic acid.

The adoption of local measures for preventing the formation of phosphatic calculi is much oftener crowned with success.

As these stones are always caused by the decomposition of alkaline urine in the presence of cystitis, the indications are (*a*) to drain the bladder by removing a stricture, if present, evacuating residual urine, in cases of enlarged prostate or atony, and distention of the bladder in paralytics, and (*b*) to cure the existing cystitis by bladder washing.

In this way the decomposition of urine is checked and the precipitation of phosphates and carbonates ceases.

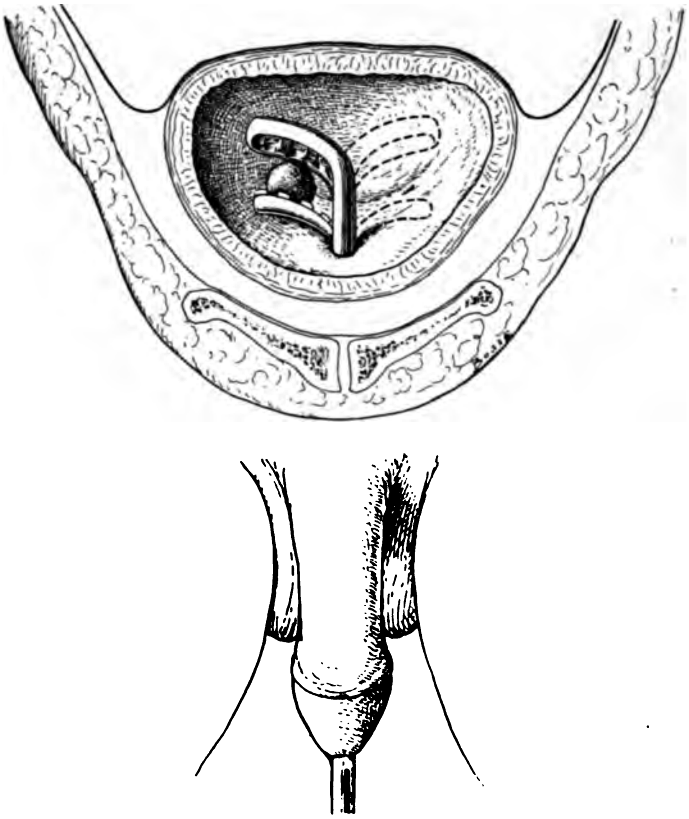

Fig. 179.—Maneuver for grasping the calculus with the lithotrite when it fails to engage between the jaws.

Attempts to dissolve stones after their formation have been made for many years, but, while some have been moderately successful in the laboratory, no method has yet been found which is capable of dissolving a stone in the bladder.

The various waters from mineral springs which have derived some reputation as solvents owe it to the fact, already spoken of, that in a few extremely rare instances ***spontaneous fracture*** of the stone occurs when the specific gravity of the fluid surrounding it is altered.

## Operative Treatment

**Litholapaxy,** or crushing the stone and immediately washing out the fragments from the bladder, is the operation of choice in all cases of vesical calculus.

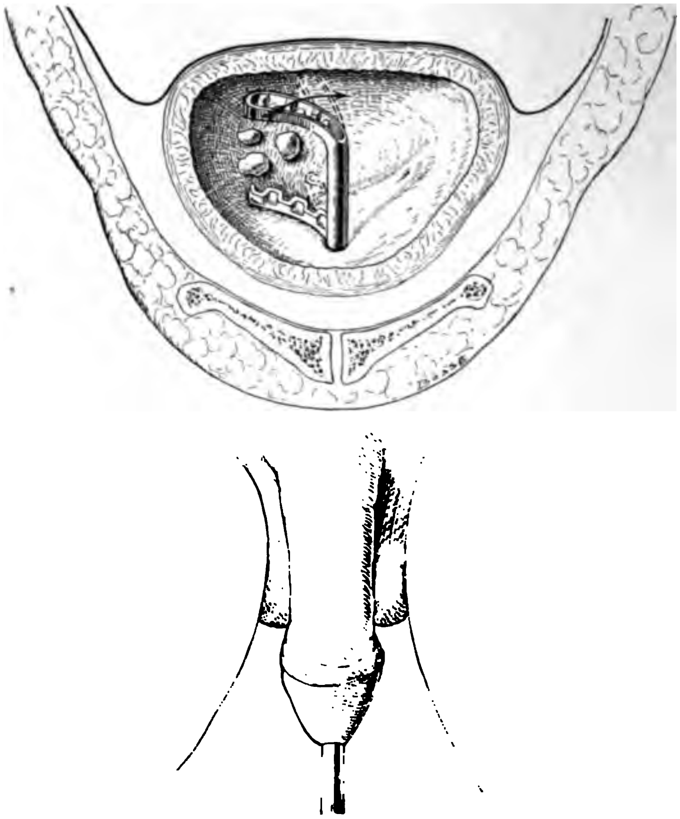

Fig. 180.—Maneuver for grasping fragments in intimate contact with posterior wall.

It is a prerequisite of the operation that: I. The lithotrite and evacuating catheters should be introduced easily and without wounding the urethra or prostate. In children under sixteen years of age litholapaxy is regarded by many surgeons as inadmissible on account of the small size of the bladder and urethra.

It is advised, however, by others whenever the urethra is large enough to admit the instruments.

II. The stone must be *movable in the bladder,* of *moderate* size, and *not too hard.*

If a stone lies in a saccular dilatation or is adherent to the bladder wall, it can not be crushed. Very large stones form such a great quantity of *débris* after crushing that the operation of washing out becomes too protracted.

The *contraindications* to litholapaxy are (*a*) extreme prostatic hypertrophy. The prostate may be so much enlarged that the lithotrite can not be introduced, or, even if passed into the bladder, it can not reach and grasp the stone as it lies in the postprostatic pouch.

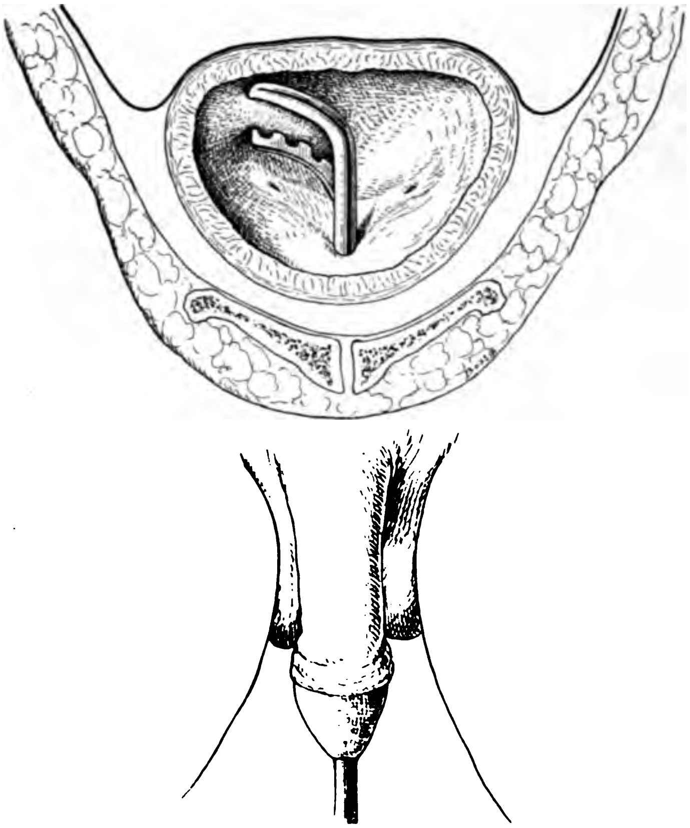

Fig. 181.—Accidental grasping of mucous membrane of bladder between jaws.

(*b*) Tight stricture of the deep urethra. Such a narrowing of the urethra will prevent the passage of the instruments, and requires external urethrotomy for its cure, and, at the same time, the stone may be removed through the perineal wound, although if very large it may have to be crushed with a lithotrite first.

(*c*) Severe cystitis which does not yield to ordinary treatment. In this condition it is better to remove the stone through an incision, which will subsequently serve for the prolonged drainage of the bladder and at the same time afford an opportunity for its irrigation.

(*d*) Contracted and irritable bladder does not admit of sufficient distention, and is too intolerant of instruments to allow the stone to be crushed.

(*e*) Nephritis and suppurative pyelitis, since uremic coma and death follow litholapaxy, when the kidneys are diseased, more frequently than after the cutting operations.

*Technic.* The patient, with his rectum previously emptied, is anesthetized, lying upon his back. The hips are elevated by a cushion placed under the buttocks, to allow the stone to roll out of the postprostatic pouch.

The bladder is washed out and filled with six to eight ounces of boric acid solution or oxycyanide-of-mercury solution.

The lithotrite is passed through the urethra after the manner of a sound, and rests on the floor of the bladder behind the prostate, with its beak pointing upward. The lithotrite, from its weight, sinks in and forms a depression in the wall of the bladder. Ordinarily the stone lies along the beak of the lithotrite, and when the jaws are opened it rolls in between them. This manipulation is facilitated by giving the patient's pelvis a couple of shakes, thus causing the stone to roll in the bladder. The jaws are closed and the stone is felt to be grasped. If the jaws fail to seize the stone, the blades are opened in the upright position, turned over on one side, and shut along the floor of the bladder. If the stone is not found, the maneuver is repeated in the opposite direction.

If the stone lies in a deep postprostatic pouch, raising the patient's hips may roll it out within reach, or it may be pried up by a finger in the rectum.

In the event of these failing, the jaws of the lithotrite may be turned so as to point downward, in the hope of seizing the stone as it lies; but in this case there is always danger of nipping and cutting out a piece of the bladder wall.

When the stone has been caught between the jaws, the resistance it offers is easily felt on approximating them. The blades of the lithotrite are then locked, and by turning the handle the jaws are screwed together, comminuting the stone into fragments. The maneuvers of opening the jaws, catching the stone, and breaking it are repeated until the surgeon perceives that no large fragments are left, and the lithotrite is withdrawn.

The next step is the *evacuation of the débris.* The evacuating tube is introduced into the bladder and its contained fluid allowed to flow out with a gush, carrying with it some of the fragments. The bladder is then filled with water by pumping in the contents of the bulb, and the fluid then flows out again into the receiver, carrying more fragments. The pumping is continued until no more fragments come away, and auscultation over the bladder fails to perceive the click of a fragment remaining behind which is too large to enter the tube. If this is the case the lithotrite should be introduced again and the piece crushed and pumped out.

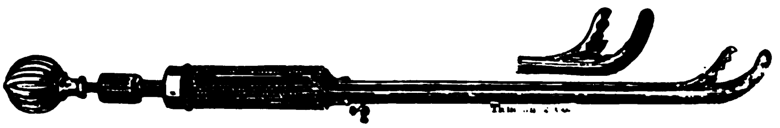

Fig. 182.—Bigelow's lithotrite.

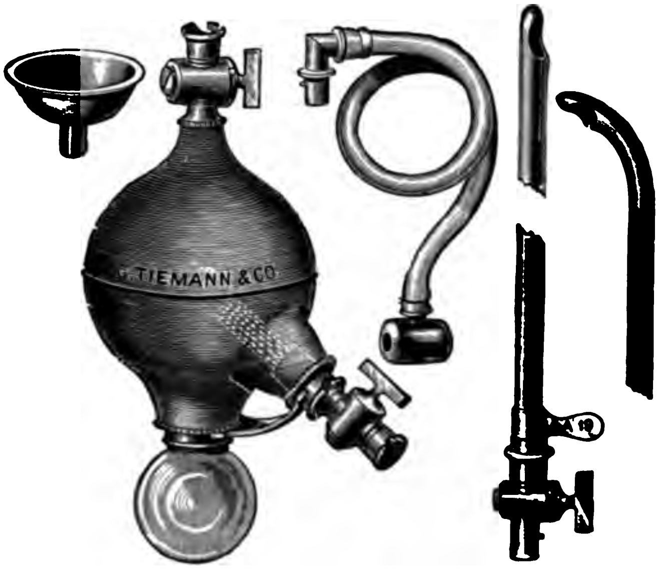

Fig. 183.—Bigelow's evacuator.

The after-treatment consists in keeping the patient in bed and allowing him to drink freely of water, to keep the kidneys active.

If retention of urine occurs, it is well to tie a catheter in, in order to avoid the irritation of its frequent passage.

After ten days have passed the bladder should be pumped once more to remove the sand and mucus which are left and which might serve as a nucleus for another stone, and the entire absence of fragments should be verified by a cystoscopic examination.

*Mortality of Litholapaxy.*—The following statistics, compiled by Cabot, show the death rate at different times of life:

| | | | | | |
|---|---|---|---|---|---|
| Children, under 14, | 214 cases, | with | 4 deaths | = 1.66 | per cent. |
| Adults, 14 to 50, | 400 " | " | 13 " | = 3.25 | " " |
| Old men, | 433 " | " | 26 " | = 6. | " " |

**Perineal Lithotomy.**—Until within a few years, and before the technic of litholapaxy and suprapubic lithotomy was perfected, the only way of removing a stone was through a perineal incision.

As these methods came into general use, the perineal operation was to some extent abandoned, except in children; but when a cutting operation is required, perineal lithotomy possesses the advantage of causing less shock than the suprapubic operation, and is well adapted to the removal of small stones and for certain complications which are described below.

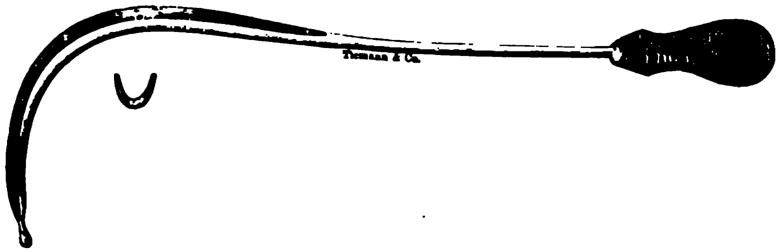

Fig. 184.—Lithotomy staff.

Perineal lithotomy offers the advantage of good drainage for the bladder; but if an attempt is made to remove a large stone through the perineal wound, the bruising and laceration of the tissues often lead to infection and sloughing.

In addition, a large stone requires such an extensive lateral incision through the prostate that many blood vessels are divided and hemorrhage may be difficult to control.

Perineal lithotomy has always been considered a dangerous operation in the case of old men with enlarged prostates, on account of the bruising and laceration to which the prostate is subjected while the stone is being withdrawn.

Hypertrophy of the prostate adds very much to the difficulty of reaching a stone from the perineum, on account of the increase of the perineal distance and for that reason it is generally better to enucleate the prostate by the suprapubic route and remove the stone through the same incision.

If the stone is too large to extract through the perineal incision, Harrison's lithoclast may be used to break it up into fragments, which can be readily brought out through the wound.

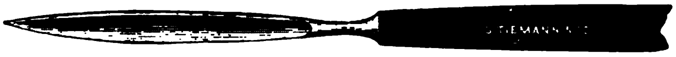

Fig. 185.—Lithotomy knife.

The indications for **median perineal lithotomy** may be tabulated as follows:

(*a*) Small stones of not more than 1¼ inches in diameter, complicated by stricture of the urethra, which demands external urethrotomy.

(*b*) Small stones in the presence of atony of the bladder with no expulsive power, and chronic cystitis, provided that the prostate is not very much enlarged.

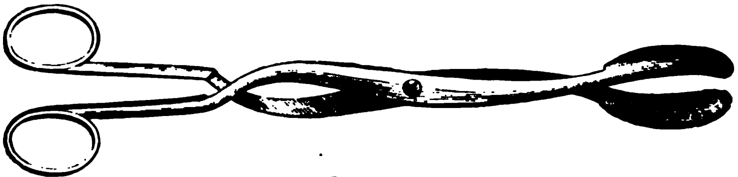

Fig. 186.—Lithotomy forceps.

(*c*) Contracted and irritable bladder, which does not admit of sufficient distention for suprapubic cystotomy and is too intolerant to allow litholapaxy.

(*d*) Small or moderate-sized stones, complicated by senile hypertrophy of the prostate, which is suitable for the operation of perineal prostatectomy.

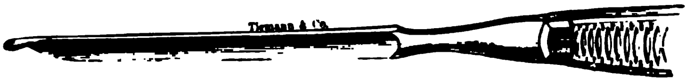

Fig. 187.—Blizard's probe-pointed knife.

**Perineal Lithotrity.**—Reginald Harrison has enlarged the scope of median lithotomy by devising a lithotrite which is introduced through a median incision and by which stones of considerable size can be crushed in the bladder and removed through the perineal wound.

*Perineal Lithotomy.—Technic.*—(*a*) ***Median Operation.***—An incision is made in the median line, which is simply a ***boutonnière,*** or external urethrotomy, and is performed by introducing a grooved lithotomy staff through the urethra into the bladder.

The staff is held steadily by an assistant and the surgeon makes a direct thrust or stab with a long, straight bistoury, an inch and a half in front of the rectum, through the tissues lying in front of the urethra, and strikes the groove in the staff. A gorget is then slid along the groove until it enters the bladder, which is explored by means of the finger. If a stone is found, it is grasped by the stone forceps and withdrawn, if not too large.

If the stone proves too large to pass through the wound, (*b*) *perineal lithotrity* may be performed by introducing Harrison's lithotrite, crushing the stone, and either extracting or pumping out the fragments with a litholapaxy evacuator.

The operation may, if desired, be converted into (*c*) *lateral perineal lithotomy*, which was the operation formerly used exclusively in all cases of stone. A Blizard knife is slid along the groove in the staff, as it rests in the bladder, until the point of the knife has entered the bladder. The knife is then withdrawn, making a sweeping cut, outward, downward, and a little to the left, enlarging the original median incision and cutting through the left lobe of the prostate, the perineal muscles, and the skin.

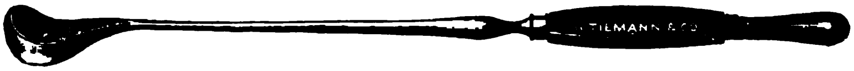

Fig. 188.—Lithotomy scoop.

In this way the incision is made of sufficient size to permit the extraction of large stones with the forceps or scoop; but, on account of the drawbacks of hemorrhage and laceration of the tissues, this form of lithotomy is rarely used at the present time, for a stone large enough to require such an extensive incision is best removed by a suprapubic cystotomy.

*After-treatment of Perineal Lithotomy.*—The wound is never sewed, but is left to heal by granulation. Hemorrhage is inconsiderable after the median operation, and is easily controlled by a gauze packing around a large soft-rubber catheter. It is often very severe after a lateral lithotomy, and often requires the use of the shirted cannula to hold it in check.

The *mortality of perineal lithotomy* has been tabulated by Freyer and Rosenthal, as follows:

| | |
|---|---|
| Deaths before the 20th year | 5 to 8 per cent |
| " in adults | 10 " 15 " " |
| " above the 40th year | 32 " 39 " " |

These figures refer, in the main, to the operation of lateral lithotomy, and apply less to median lithotomy or lithotrity.

**Suprapubic Lithotomy.**—Suprapubic lithotomy was first performed in the year 1550 by Pierre Franco, but did not gain favor until 1880, when the application of aseptic methods and improvements in the technic of the operation reduced the previously high rate of mortality.

At the present time, in the cases where litholapaxy can not be applied and a cutting operation must be employed, suprapubic lithotomy is the operation of choice in dealing with stones over 1½ iches in diameter.

The *advantages* of suprapubic over perineal lithotomy are:

(*a*) The suprapubic operation admits of complete inspection and evacuation of the bladder.

(*b*) Wounding the ejaculatory ducts, neck of the bladder, and rectum, and dangerous hemorrhage from incised blood vessels are avoided.

(*c*) The laceration and bruising of the tissues, which occur when a *large* stone is dragged through a perineal wound, are avoided.

(*d*) The bladder is rendered easy of access, while in the presence of a considerable degree of prostatic hypertrophy the perineal distance is so much increased that it may be impossible to reach the bladder from below.

The *disadvantages* are:

(*a*) A much greater degree of shock and prostration following the operation than exists after perineal lithotomy.

(*b*) The difficulty of keeping the patient's bed and dressings from being soaked with urine which escapes from the suprapubic wound.

The special indications for suprapubic lithotomy have been tabulated as follows:

(*a*) Very large stones, even though they are soft. (*b*) Large hard stones. (*c*) All fixed stones, incrustations of the bladder wall, sacculated stones etc. (*d*) Cases where a high degree of prostatic hypertrophy exists which prevents the seizure of the stone by the lithotrite.

The technic of the operation is based upon the anatomic fact that, when the bladder is filled, the fold of peritoneum, which lies in front of it, is raised up two inches above the pubes, leaving a space, called the space of Retzius, or prevesical space, *uncovered* by *peritoneum,* through which the bladder wall may be safely incised.

*Technic.*—The India-rubber bag which was used in the earlier operations for distending the rectum, and so bringing the bladder nearer to the abdominal wall, is rarely, if ever, employed at present. The Trendelenburg position is of great aid in preventing the intestines from being wounded.

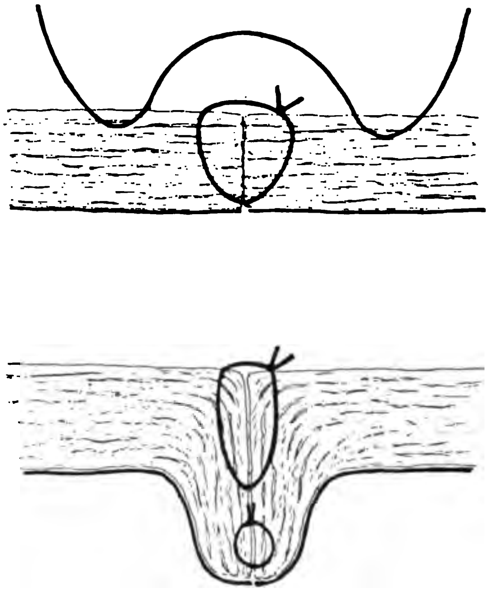

Fig. 189.—Suturing the bladder in two layers. First row includes muscular coat, but not the mucous membrane; second row includes the serous covering of the bladder and buries the first row.

A catheter is introduced through the urethra and the bladder is filled with from eight to twelve ounces of sterilized water, by means of a syringe. Helferich and Bristow use air for this purpose.

The catheter is withdrawn and a rubber band is tied around the root of the penis.

An incision is made in the median line of the abdomen, beginning three inches above the pubes and extending down over it, which divides the skin and subcutaneous fat. There is no linea alba in this region and the incision is carried directly through the muscular bundles, and the transversalis fascia is divided. The edges of the wound are held apart by large angular retractors and the bladder appears lying at the bottom of the wound. It is recognized by its shape and by the prevesical fat, which is adherent to it. If any doubt exists, it may be punctured with an exploring hypodermic syringe.

In old men the peritoneal fold in front of the bladder is sometimes unusually long, and extends down low, into the space of Retzius. In such a case it should be peeled up from the bladder and held out of the way. If the peritoneum is accidentally wounded, it should be at once sewed up with fine silk.

After the bladder is exposed, it should be steadied with a sharp hook, thrust through its wall at the upper angle of the wound, and two long silk retraction sutures are passed through the bladder walls, at the sides of the wound.

These are held by an assistant and the bladder is opened between them by means of a scalpel. As the water in the bladder is flowing out, the incision may be enlarged to the desired extent by means of a straight, blunt-pointed bistoury.

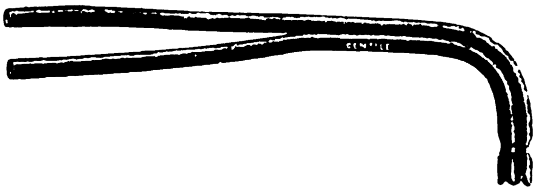

Fig. 190.—Guyon double tube for drainage of the bladder after suprapubic cystotomy.

The cavity of the bladder is then searched with the finger, and the stone removed with a lithotomy scoop or forceps. If it is desired to inspect the interior of the bladder, its walls may be distended by Watson's bladder speculum and the cavity illuminated by Pilcher's electric lamp or a head mirror and reflected light. A thorough exploration of the interior of the bladder can best be obtained by dividing a portion of each rectus muscle transversely, and by inserting three right-angled retractors, two at the sides and one at the upper angle of the incision into the cavity of the bladder. This extensive exposure is not called for in an uncomplicated case of stone, but only where a bladder tumor is present as a complication.

The period of wound healing is very much shortened by sewing the bladder at the completion of the operation, and it may be closed completely in young and middle-aged persons when only a moderate degree of cystitis is present. The bladder should be sewed with two rows of catgut sutures: the first row includes the muscular wall and brings the mucous membrane close together, and the second row is a sort of Lembert, bringing the serous coats in contact and burying completely the first row.

Drainage of the bladder should be provided for by laying in a Pezzar catheter, but, as a certain amount of leakage of urine is very apt to occur, the space of Retzius should always be packed with gauze and the lower angle of the wound left open after the recti muscles and skin have been sutured.

In old men and in the presence of severe suppurative cystitis and ammoniacal urine it is always safer to provide for drainage of the bladder by introducing a Freyer or Guyon tube into its cavity through the abdominal incision and suturing the bladder and abdominal wall around the tube with gauze drainage in the space of Retzius.

The length of time required for the healing of the wound is from two to three weeks when the bladder is sutured, and from three to six weeks when the wound is left to heal by granulation.

The *mortality statistics* of suprapubic lithotomy collected by Cabot show the following results:

| AGE | CASES | DEATHS | PERCENTAGE |
|---|---|---|---|
| Adults, 14 to 50 years | 100 | 12 | 12 |
| Old men | 53 | 17 | 32 |

## Operations for Calculus in Children

**Perineal Lithotomy.**—The median operation is impracticable in children, on account of the difficulty in withdrawing a stone through the small posterior urethra. For the same reason Harrison's lithotrite can not be used. The lateral operation, however, can be readily performed with much greater safety than in adults, for, as the prostate and urethra grow larger, they become more vascular, and the danger of hemorrhage increases.

The lateral operation has a drawback in the danger of wounding the ejaculatory seminal duct and producing sterility on that side, in after-life. The mortality is about 3 per cent, and lateral lithotomy is still generally considered to be the operation of choice in the case of small stones in children.

**Litholapaxy** in children is attended with some difficulties, on account of the small size of the urethra interfering with the introduction of the lithotrite and the relative hardness of the stones, as met with. In spite of this it has been performed a great many times, and the death rate is low: only about 3 per cent. So far as the death rate is concerned, there is but little choice between lateral lithotomy and litholapaxy.

**Suprapubic cystotomy** in children is more dangerous, according to the collected statistics, than either of the other operations, the mortality being about 10 per cent, although stones one and one-quarter inches in diameter or over are considered too large for lateral lithotomy and must be removed through a suprapubic incision.

The size of a stone is readily estimated in children by the bimanual examination with one finger in the rectum and the other hand over the bladder.

## BILHARZIA HEMATOBIA[1]

Bilharzia hematobia is a disease occurring in South Africa, Egypt, and along the Nile, and is caused by a parasitic worm, which is taken into the human organism through the legs or directly up the urethra when bathing.

The adult worms develop in the portal veins, taking from three to six months to attain maturity, from which they make their way to the pelvic veins, and, having anchored in the bladder walls, proceed to hatch out brood after brood of eggs. They usually live for three or four years, and if the infected person leaves the country he may expect the parasites to die out in about four years' time, but the symptoms usually disappear before that.

The characteristic symptom is the passage of a few drops of blood at the end of urination, and the eggs of the parasite can be found with the microscope in the last portion of the urine voided. Examination with the cystoscope shows the bladder wall dotted over with brilliant, white spots, surrounded by healthy mucous membrane, the white spots being the tails of the adult worms seen through the mucous membrane.

### Treatment

When the disease is established it must be left to die out of itself, although fluidextract of male fern, in 15-minim doses three times a day for a fortnight, is said to be of value, and any irritation of the bladder can be controlled by giving 3 grains of methylene blue twice a week.

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[1] Kidd: "Urinary Surgery," London, 1910.

If cystitis or calculus is present they must be treated on general principles.

## ULCER OF THE BLADDER

Ulcers of the bladder are not infrequently seen in cystoscopic clinics where students are being taught the use of this instrument, and are caused by an incorrect judgment of the distance between the hot lamp and the bladder wall.

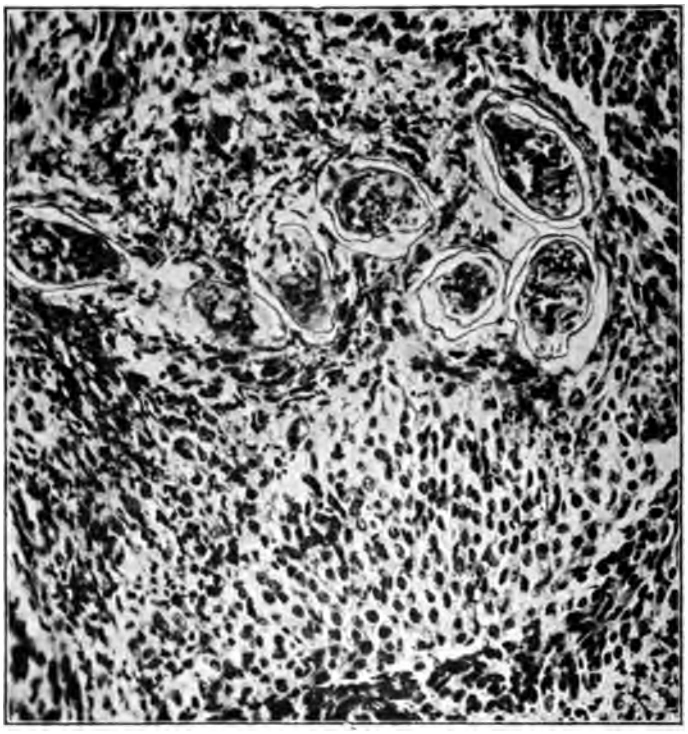

Fig. 191.—Bilharzia embryo.

They also occur in tuberculosis, cystitis, and malignant tumor, but very rarely a solitary ulcer the size of a 10-cent piece in an otherwise healthy bladder, and without history of traumatism or injection, is met.

The cause is unknown, but is thought to be probably due to an infective embolus of bacteria deposited in the bladder wall.

The ulcer occurs in young persons with no venereal history, and is characterized by increased frequency of urination by night as well as by day, and hematuria, which may be profuse. The urine contains a few pus cells, but no bacteria. After a time cystitis is established and the urine becomes purulent.

The tendency of the ulcer is to increase in size; after a time it becomes covered with phosphatic incrustations, and after persisting for a considerable length of time frequently heals and causes a certain amount of contraction of the bladder.

The diagnosis is made by finding with the cystoscope a solitary ulcer on the posterior wall of the bladder, to the inner side of the ureters, and excluding all other known causes of ulceration.

### Treatment

The usual treatment for a cystitis may be employed, but usually fails, although the writer cured one patient with strong instillations of nitrate of silver. After milder measures have been unsuccessfully used, it may be possible to expose the ulcer through an endoscope, and curette or paint it with silver-nitrate solution.

If this fails, Albarran advises suprapubic cystotomy, free exposure of the interior of the bladder, excision of the ulcer and an area of mucous membrane surrounding it, and suture of the incision in the mucous membrane, with closure of the bladder and drainage by tied-in catheter.

Since the introduction of the Oudin current into urologic practice, the treatment by incision has largely fallen into disuse.

In the presence of a small nontuberculous ulcer of the bladder, a few fulgurations by means of the Oudin current will generally stimulate the ulcer to heal, and it becomes completely cicatrized in a short time.

# CHAPTER XXIV

# BACTERIURIA

This condition is characterized by the quantities of bacteria which are found growing in the urine, which is entirely free from pus. The mucous membrane of the bladder is perfectly healthy and the infection is confined to the urine alone.

On inspection the urine appears turbid and of a whitish-yellow color, and the odor is very disagreeable, resembling stale fish or feculent material.

On centrifugating and examining the sediment microscopically, it is found to be composed of the *Bacillus coli communis* in enormous quantities. Pus and epithelial cells exist in very small numbers.

It is often impossible to trace the manner in which the bacteria gain access to the bladder, although in most of the cases reported there has been a condition of hematuria, enlargement of the prostate requiring catheterization, stricture, or recent gonorrhea, and in women a recent inflammation of the pelvic organs. It is therefore supposed that the bacteria enter the bladder (*a*) through the urethra, (*b*) with the urine from the kidneys, (*c*) from the general blood current, or (*d*) from adjacent organs through the lymphatics, although their place of proliferation is not discoverable.

## Symptoms

The symptoms of bacteriuria are not marked, and the turbid urine with a foul odor is often the only sign.

Sometimes the urination is frequent and urgent, and accompanied by a burning pain in the urethra, and rarely a chill followed by fever, which resembles urinary fever in its onset and course, is noted.

## Course

The course of the disease is variable, occasionally brief and transient, sometimes more protracted, with remissions alternating with exacerbations and it often becomes chronic, lasting for years.

## Prognosis

The prognosis is rather unfavorable as regards a cure, unless the place of bacterial growth is accessible. If this is not the case, the bacteria are apt to remain permanently in the urine, but the general health does not suffer and the urinary organs remain in a healthy state.

## Diagnosis and Treatment

The diagnosis can only be made by excluding cystitis and finding the bacteria in the urine with the microscope.

The treatment consists in first removing any possible source of growth for the bacteria by relieving habitual constipation or enteritis. If the breeding place of the microorganisms is in some local condition, such as a posterior urethritis or stricture, it should be removed.

When no cause is discoverable, the administration of urinary antiseptics internally—salol, methyl blue, and urotropin—in order to destroy the bacteria, is called for. The patient should drink freely of pure distilled or spring water in order to mechanically wash out and remove the fermenting contents of the bladder.

Bladder washing with solution of nitrate of silver or sublimate is, in general, of little use, and still at times it may be of some value and oxycyanide-of-mercury, 1:4000, irrigations may also be tried.

In cases which do not respond to this treatment, Rovsing has been successful in causing a disappearance of the bacteria by laying a permanent catheter in the urethra and keeping the bladder empty.

If the bladder is not kept empty, the organisms have an opportunity of growing in the urine which lies in the bladder between the intervals of urination; but if no urine is retained in the bladder, their growth is prevented from lack of a suitable culture medium.

# CHAPTER XXV

# ENURESIS IN CHILDREN

Nocturnal incontinence of urine is a very frequent source of annoyance in childhood. It may continue uninterruptedly from infancy, or may begin after the fourth or fifth year, and affects boys and girls with equal frequency.

The incontinence usually occurs only at night, as during the day the child is able to control it by the exercise of the will; but sometimes the irritability of the bladder is so marked, even by day, that unless the child responds at once to the call the urine is passed in the clothes. At night the emptying of the bladder does not take place when it is overfilled with urine, but usually occurs three or four hours after going to bed.

## Etiology

The etiology of enuresis is very obscure, and it has been variously regarded as a paralysis or faulty development of the sphincter vesicæ, as a spasmodic contraction of the detrusor, or as a mere irritability of the posterior urethra.

Casper explains the condition by assuming that there is a faulty relation between the innervation of the detrusor muscle of the bladder and its sphincter. This permits of a spasmodic contraction of the detrusor which is strong enough to overcome the muscular tone of the sphincter.

Before deciding that the trouble is purely functional, it is necessary to exclude certain local conditions, such as balanitis or phimosis, irritation in the rectum from pinworms or obstinate constipation, vesical calculus, cystitis or tuberculosis of the bladder, foreign body in the urethra or a narrow meatus, excessive acidity of urine and in female children an adherent clitoris.

General conditions may also play a part more or less directly in causing enuresis; epilepsy, rachitis, diabetes, polyuria, and nephritis may all be responsible for this symptom.

A want of proper bringing up may here and there be responsible for the condition, and in a few cases it is due in the first place to carelessness. The child wakes at first, but will not take the trouble to get up to empty his bladder. Later on he does not wake up thoroughly and voids the urine in the bed semiunconsciously.

### Treatment

Treatment is generally effective, both in the cases where a cause can be discovered and removed, and also in the purely functional cases.

The child should be awakened once or twice at night and made to empty his bladder, and he should sleep on a hard mattress and not too warmly covered.

A frequent cause of enuresis, according to Holt, is preputial adhesions, which should be broken up and the smegma removed. If phimosis is present it should be relieved by stretching or by circumcision. A narrow meatus should be cut to the proper dimensions. In girls an adherent clitoris is often responsible for the incontinence and the adhesions must be broken up, offering prompt relief.

If stone in the bladder is suspected and if micturition is accompanied by straining and painful spasm, the bladder should be sounded. Pinworms in the rectum should be treated by salt water injections or other preparations. The reaction of the urine should be ascertained and if uric acid crystals are found, alkalies are indicated with a great deal of water.

The child should not be overtaxed at school and all excitement must be avoided. The diet must be carefully regulated and coffee, tea and beer prohibited. Sweets and all highly seasoned foods must be eliminated from the diet. Dr. Holt's experience is that the exclusion of meat is not indicated. The amount of water should not be limited except, perhaps, late in the afternoon a less quantity should be taken. The best diet is composed of milk, vegetables, fruits, meat and cereals. Punishment is of no value, and in most cases is harmful. The moral treatment is recommended, appealing to the child's pride and endeavoring to strengthen his will. When the incontinence is only at night the child should be instructed to retain the urine as long as possible during the day in order to accustom the bladder to a greater amount of water. Any anemia, malnutrition, indigestion and constipation must be corrected. Adenoids must be looked for and removed, as they tend to increase the irritability of the nervous system.

*Belladonna* is the drug upon which most reliance is to be placed.

It should be given in increasing doses until the physiologic effect is obtained or until the child is cured.

The dose, on beginning, for a child four years old, may be three drops three times a day, increased one drop daily. When ten or fifteen drops of tincture of belladonna have failed to control the enuresis, aromatic tincture of rhus has been successfully used, increasing the dose gradually to 30 minims a day.

If this fails, Osthiemer and Levi[1] advise a solution containing $\frac{1}{240}$ grain of atropine and $\frac{1}{480}$ of strychnine to the drop. The initial dose of this is one drop a day, increased one drop daily until symptoms of the physiologic action of atropine or strychnine appear or the enuresis ceases. Under these plans of treatment 75 per cent of recoveries may be expected.

*Elevating the foot of the bed* on two chairs is recommended by Stumpf, as in this way the urine in the bladder does not press down against the sphincter. The explanation of the method of action is not entirely clear, but the clinical fact is well attested.

*Faradization of the bladder* three or four times a week is a valuable measure. One pole is placed over the bladder region against the symphysis, and the other is carried into the rectum. The strength of the current is graduated to the patient's feeling and is often followed by success.

In cases where these measures fail, local treatment of the urethra with sounds and instillations of nitrate of silver may be tried. On account of the timidity and nervousness of children, it is very difficult to use instrumentation of any sort within their urethras, and the liability of a sudden movement causing a false passage must always be borne in mind.

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[1] Jour. Am. Med. Assn., Dec. 17, 1904.

## CHAPTER XXVI

# SENILE HYPERTROPHY OF THE PROSTATE

The prostate is placed like a sphincter around the first inch of the urethra between the bladder and the membranous urethra. It was formerly taught that it was composed of two lateral lobes and a median central portion connecting them, which is sometimes spoken of as a third, or median lobe.

The investigations of Lowsley,[1] however, have shown the prostate to be composed of five lobes; viz.,

The *middle lobe,* or that part of the gland which is situated between the bladder and the ejaculatory ducts under the floor of the urethra (prespermatic and posturethral). *Lateral lobes* or those parts of the gland which arise from the prostate furrows and the lateral walls of the urethra and extend laterally and posteriorly from that structure. *Posterior lobe,* or that part of the prostate which lies dorsal to the ejaculatory ducts above their entrance into the urethra and dorsal to the urethra below this point (postspermatic and posturethral.) This is the part of the prostate which is felt per rectum. *Ventral lobe,* or that part of the organ formed by glands arising from the anterior or ventral wall of the prostatic urethra.

## Histologic Anatomy

The prostate reaches its full normal development[2] about the twentieth year. The capsule or external portion is not a true capsule in the sense that it can be easily separated from the gland, but it is made up of musculoconnective tissue from which bands extend into the body of the gland surrounding the alveoli of the glandular structure. The various lobes normally have no distinct capsular separation from each other. The gland tissue communicates through numerous duct openings with the posterior urethra. It is through these openings and along the tubules that infection easily finds its way into the prostate gland from the urethra.

The prostate is in close relation with the bladder, it surrounds the urethra, is attached to the pubic arch and is very narrowly separated from the rectum. A dense plexus of veins partially envelops it.

In its histologic structure it resembles the uterus in the female, and is composed of muscular fibers, glandular elements, and a connective tissue stroma uniting them.

While the gland may be enlarged as a result of gonorrhea or sexual abuses in young men, *true hypertrophy* of the prostate never occurs until the decline of life, when other degenerative changes incident to advancing years begin. It is very seldom observed until the patient is *past his fiftieth year.*

Sir Henry Thompson states that hypertrophy of the prostate exists in 34 per cent of men at and above 60 years of age, and that it produces manifest symptoms in about 15 or 16 per cent of the cases when it is enlarged.

For many years the *cause* of prostatic hypertrophy was the subject of much speculation, although Virchow, in his work on tumors, stated that it was due to chronic inflammation which started in the glandular substance of the prostate.

This view did not attract much attention, and the general opinion was that a certain amount of enlargement of the prostate was a senile process.

In very recent times the work of Ciechanowski,[3] published in 1900, and of R. H. Greene and Harlow Brooks,[4] of New York, demonstrated positively that the enlargement is due to a chronic inflammatory process, which usually has been in progress for many years.

In frequent instances this inflammation may be of gonorrheal origin, but not necessarily so.

The inflammation begins in the prostatic urethra, near the verumontanum, and when not due to gonorrhea may be very often accounted for as the result of excessive irritation from overfunctional activity or from some form of unphysiologic sexuality, such as masturbation or coitus reservatus.

These acts lead to a violent engorgement of the posterior urethra, and, unless the congestion is relieved by a period of absolute rest, the tendency to a low grade of chronic inflammation soon develops, in which, no doubt, microorganisms carried by the blood current or urine have a contributory action.

## Pathology[5]

The pathologic change consists in a general enlargement of the entire organ, or the increase in size may be confined to one or both lateral lobes or to the median lobe. The character of the enlargement of the gland and its size and consistency depend upon which of the normal tissues of the prostate have been chiefly affected by the process of hypertrophy.

Prostatic hypertrophy occurs in two distinct forms, fibrous and adenomatous. The **fibroid variety** of hypertrophy is due to a hyperplasia of the connective tissue elements of the prostate, which lie between the tubules.

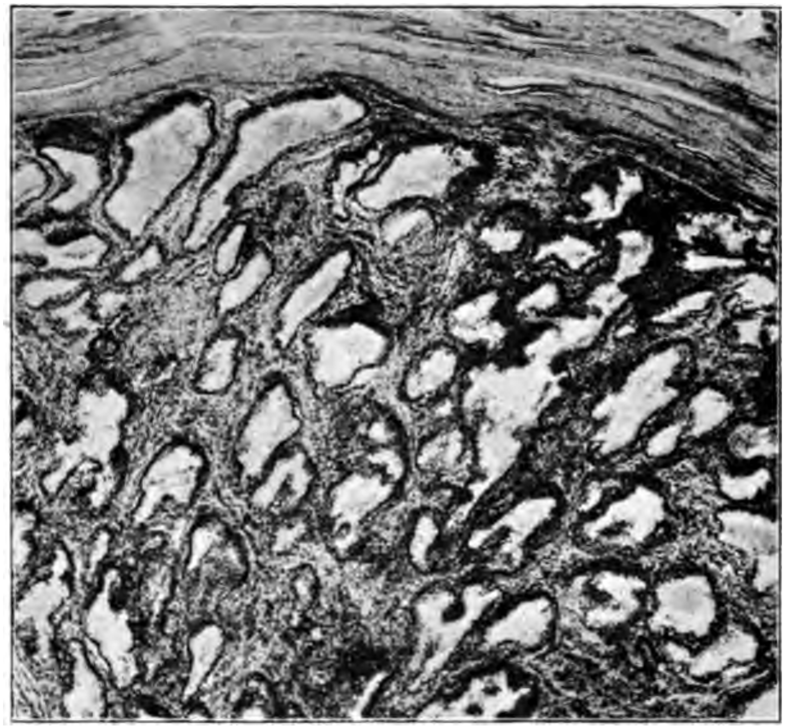

Fig. 192.—Hypertrophied prostate. Adenomatous type.

The growth and contraction of this tissue result in the compression of the gland tubules, which atrophy in consequence, so that in the pure fibrous hypertrophy the gland is transformed into a firm fibroid mass, containing a few glandular elements.

This variety is often irregular in shape, for the reason that the hyperplasia does not take place equally in all parts of the gland.

It has been asserted that the involuntary muscle fibers in the prostate participate in this form of hypertrophy, but more recent investigations apparently exclude muscular hyperplasia.

The cause of the fibroid form of prostate hypertrophy is undoubtedly the same as that causing connective tissue hyperplasia elsewhere; viz., *inflammation*.

Connective tissue of inflammatory origin, after the acute stages which excite its growth have passed, always contracts, as in the formation of a cicatrix.

It may thus happen that a small, hard prostate will in some cases result as a terminal stage of the fibroid form of prostatic hypertrophy, although this form of pure fibroid hypertrophy is exceedingly rare.

The **adenomatous form** is characterized by the presence of round or oval tumors of a semielastic consistence, which form in the substance of the prostate gland.

In the adenomatous form the epithelial or secreting elements of the gland are involved by the hyperplasia, the result being that greater or less increase in the number and size of the tubules of the gland is occasioned. The connective tissue elements in the pure type of adenomatous hyperplasia are not at all or but slightly increased. In this form of prostatic hypertrophy the tubules of the gland frequently become dilated and elongated, and are filled with (*a*) the secretion of the cells, which is more or less inspissated; (*b*) by proliferating cells derived from the walls of the acini, or (*c*) by the detritus resulting from the disintegration of these cells.

The nodules formed may range in size from a pea to a hen's egg, and each may contain many or few acini.

This type of prostatic hypertrophy is induced by inflammation, as in the first-named variety; but in the adenomatous form the inflammation affects primarily the tissues surrounding the excretory ducts, and by the compression of these ducts the secretion becomes dammed up within the tubules of the gland, which thus become distended.

This is accompanied by an inflammation, which excites the epithelium of the secreting tubules to growth, and by the proliferation of these cells new acini are formed. It is thus evident that, while the structure of the tumor resembles that of ordinary adenomata, its etiology and manner of growth exclude it absolutely from the new-growth formations.

The cyst-like nodules formed in the adenomatous type of prostatic hypertrophy thus originate from the distention and growth of the normal tubules, which have become obstructed and hyperplastic, as the result of inflammation acting as above described.

The nodules may thus consist of a single occluded and distended tubule, with its wall, or of any number of hyperplastic tubules, of greater or less size, depending upon their individual distention.

The **mixed type** of prostatic hypertrophy is by far the most frequent. In it, both the tubules and connective tissue of the normal gland partake in the process, and as a result areas of fibrous formation are found, intermingled with enlarged and cystic tubules. Thus the nodules found in this variety consist both of fibroid masses and adenocystic tumors.

**Effect upon the Capsule of the Prostate.**[6]—The close study of hypertrophy of the prostate has shown that the tumor formation and inflammatory changes occur in the central part of the gland which does not show in the hypertrophy. The glandular tissue of the prostate is pushed out to the periphery where it forms a sort of capsule around the newly formed adenomatous mass, so that the latter may be shelled out without injury to the prostate proper.

This also explains why the genital function is not affected by prostatectomy as the adenomatous mass is merely shelled out from the surrounding capsule composed of the thinned and flattened tissue of the prostate.

**Carcinoma** not infrequently arises, as a complication of the changes described in hypertrophied prostate, as is shown particularly by Albarran and Hallè.

The **size** to which the prostate may grow depends upon the nature of the tissue involved. The prostate may be only slightly increased in size or it may become as large as a hen's egg or an orange, and in very exceptional instances may reach the size of a cocoanut, and fill up the entire pelvis.

**Form of Obstruction.**—In certain cases the lateral lobes may be enlarged, but in such a way as not to interfere with the urinary outlet, and it is possible to empty the bladder entirely. As a rule, however, **the posterior median portion, or third lobe,** becomes enlarged, and assumes the shape of a bar or dam across the mouth of the bladder, behind which the urine accumulates and can not flow out, or the outgrowth may be more circumscribed in form and act as a ball-valve, which shuts down over the vesical orifice.

Alexander has recently suggested that the enlarged prostate interferes with the rhythmical contraction of the detrusor muscle, in the region of the trigone, and the bladder, on this account, is incapable of emptying itself of the last few ounces of urine, which are normally expelled by the action of this muscle. This view will

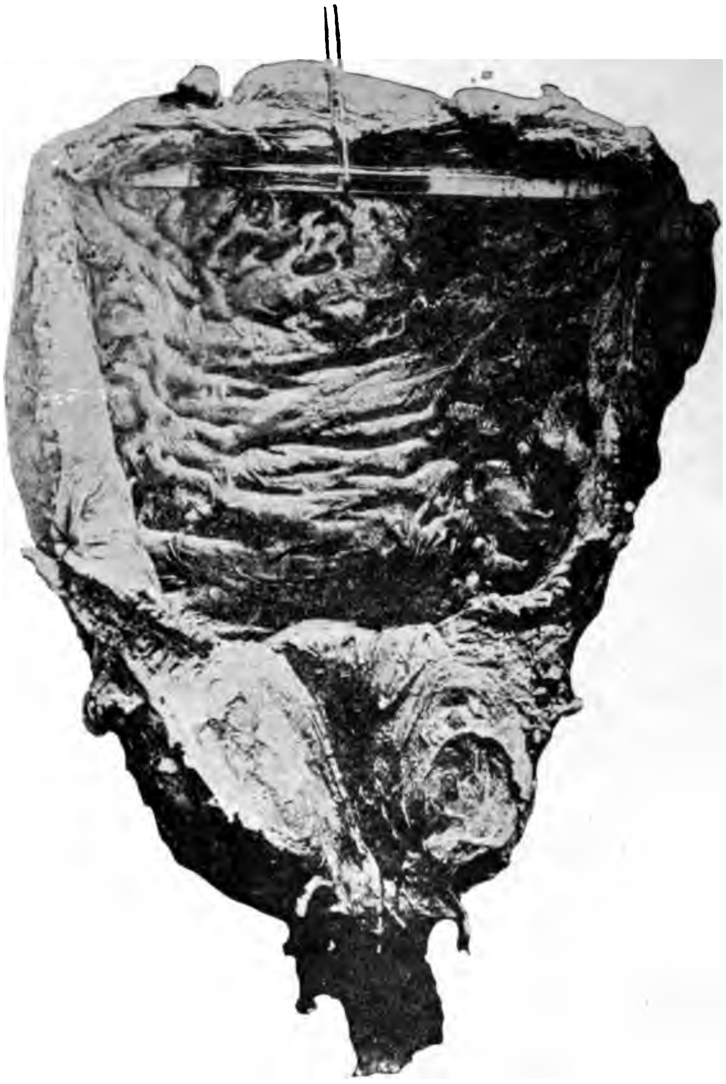

Fig. 193.—Prostatic hypertrophy. Median enlargement, in the form of a bar. Suitable for Bottini's operation. A large bladder. (Courtesy of Dr. F. S. Watson.)

serve to account for the cases in which there is no appreciable obstruction in the shape of a projecting growth from the prostate, but where residual urine accumulates.

In many instances the enlargement of the prostate does not produce any symptoms, and it is only of consequence when it acts as an obstruction placed at the outlet of the bladder, thus preventing it from completely evacuating its contained urine.

The various symptoms and diseased conditions which occur in consequence of the prostatic hypertrophy are all due to two conditions:

(*a*) The obstruction caused by the enlargement of the prostate at the vesical outlet interferes with the urinary outflow, and the bladder can not be completely emptied by the muscular efforts of the patient. Residual urine accumulates, pathologic changes occur in the bladder wall, and secondarily the ureters and kidneys become affected.

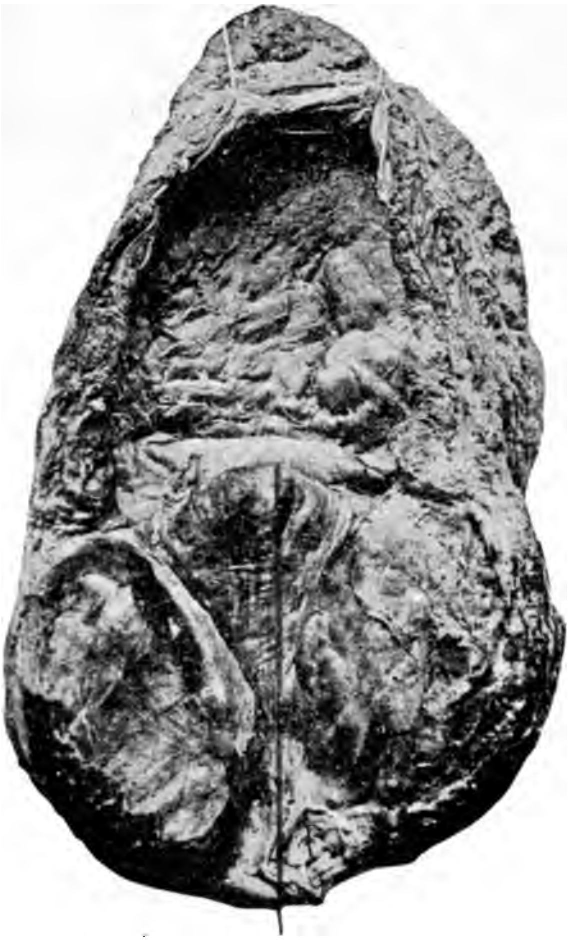

Fig. 194.—Prostatic hypertrophy. Enlargement of lateral lobes and median portion. Bladder contracted and nondistensible. (Courtesy of Dr. F. S. Watson.)

(*b*) The return flow of venous blood from the bladder wall is prevented by the pressure exerted upon the veins by the enlarged prostate, and a congestion of the bladder walls occurs as a result.

**Changes in the Urethra.**—In consequence of the enlargement of the prostate, notable alterations occur in the prostatic urethra:

(*a*) It becomes elongated.

(*b*) The normal curve is changed.

(*c*) The caliber of the urethra, instead of being round, is flattened from side to side by the pressure of the lateral lobes, so that it becomes a vertical slit.

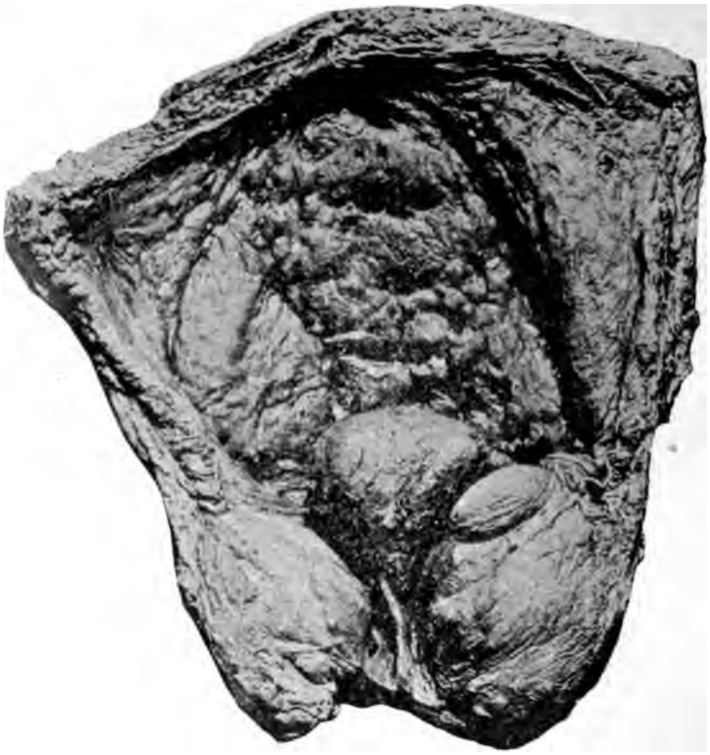

Fig. 195.—Prostatic hypertrophy. Enlargement of lateral and median lobes. Deep postprostatic pouch. Case especially adapted for suprapubic prostatectomy. (Courtesy of Dr. F. S. Watson.)

As a result of these changes catheters of ordinary shape are often inapplicable to cases of prostatic hypertrophy, and special catheters have to be employed.

**Changes in the Bladder.**—The alterations which occur in the bladder are partly due to the increased muscular effort required to empty it and partly to a secondary infection and inflammation (cystitis).

The bladder wall, especially the region of the trigone, is in a state of chronic passive congestion, which is explained by the fact that the enlarged prostate presses on the plexus of veins lying around it, and so obstructs the flow of venous blood. As the blood from the bladder is returned through this plexus, any interference with its circulation causes a passive congestion of the bladder walls. Through the day the muscular activity improves the circulation, but at night the muscles are in repose, and a passive hyperemia occurs.

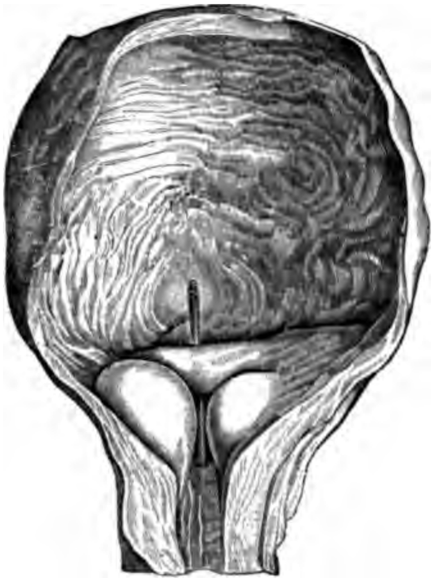

Fig. 196.—Prostatic hypertrophy. Enlargement of the lateral lobes, with increase in size of the median portion, forming a bar, through which a false passage has been made.

The increased frequency of urination at night often helps to distinguish a case of enlarged prostate from one of vesical calculus. In the case of a stone the desire to urinate is more frequent during the day, when the stone is rolling about in the bladder, but at night the patient is quiet in bed, and the stone does not cause much irritation.

One of the most important conditions from the standpoint of treatment and prognosis which enlarged prostate gives rise to is **residual urine.** Residual urine may be defined as the urine which remains in the bladder after the patient has voluntarily tried to evacuate it completely, and always occurs as a result of an obstruction.

After residual urine has existed for a varying length of time **cystitis** is generally excited by the entrance into the bladder of microorganisms, coming from the urethra or rectum or introduced artificially upon a dirty catheter.

The causation of cystitis is favored by the stagnant residual urine and also by the catarrhal mucus, which is formed in the congested mucous membrane lining the bladder, as a result of its condition of chronic passive hyperemia.

The urea of the urine is decomposed by bacterial action, assisted by the presence of the catarrhal mucus, and carbonate of ammonia is set free. The urine becomes alkaline in reaction and ammoniacal in odor, is strongly irritating, and adds still further to the existing inflammation of the bladder wall.

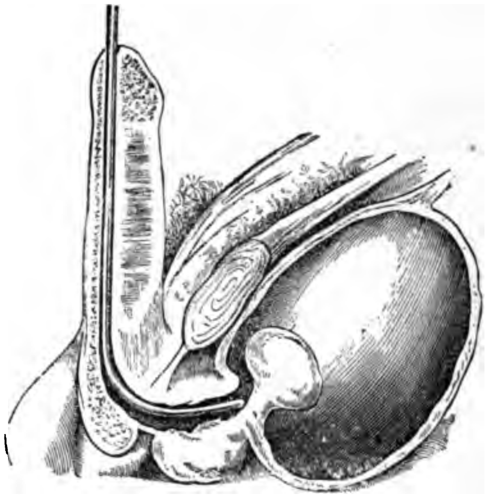

Fig. 197.—Prostatic hypertrophy. Pedunculated middle lobe obstructing passage of a catheter. Diagrammatic.

When cystitis is well established, the frequency of urination is increased, and the patient *urinates as frequently by day as at night.*

The mucous membrane of the bladder surrounding the urethral orifice becomes turgid and congested, and serves to occlude still more the outlet from the bladder, and the residual urine increases. The various changes dependent upon cystitis and obstruction lead to **changes in the wall of the bladder.** In order to furnish sufficient propelling force to overcome the obstruction formed by the prostatic overgrowth, the muscular fibers of the bladder wall undergo **hypertrophy.**

The bundles of muscular fibers grow larger and project into the bladder, thereby diminishing its capacity, and when viewed with the cystoscope they can be seen as trabeculæ. A trabeculated bladder is always a sign of increased muscular effort, and is found in every condition which requires increased muscular force on the part of the bladder to empty itself.

The muscular straining of the bladder forces the urine between the bundles of muscle, and in time **saccular dilatations** form, which may be as large as the bladder itself. As these sacs are only covered outside with peritoneum and the serous wall of the bladder and have no muscular fibers, they can not empty themselves. In consequence, the urine stagnates and decomposes, and it frequently happens that a calculus forms in them.

In course of time as the case progresses the hypertrophy gives place to **atrophy and distention.** The distention of the thinned bladder wall may be very great; so much so, that it may contain a quart of residual urine and reach as high as the umbilicus.

The distention occurs so gradually that the patient is unaware of his condition, and notices only a slight feeling of weight in the abdomen, and that his habitually frequent urination is slightly increased. As the residual urine increases, the bladder grows more distended and the intervals between the acts of urination become still shorter. After the bladder is stretched and distended to its utmost capacity a new symptom occurs; that of **incontinence of urine, or constant dribbling.**

The bladder is so full that it can hold no more, and the overtaxed sphincter yields, allowing the escape of a small quantity of urine every few minutes.

The conditions of decomposing residual urine and cystitis just described provide suitable conditions for the formation of **phosphatic calculi.** As Keyes expresses it, "Stone is the logical sequence of obstruction to urinary outflow aided by vesical catarrh."

The stagnant decomposing urine deposits salts, which become glued together by a mucopus into a solid concretion, or are deposited upon a nucleus, which may be a bit of necrotic tissue sloughed off from the bladder wall.

A single stone, or several, may exist without causing any symptoms, and they may lie unsuspected for months in the pocket behind an enlarged middle lobe. Their surfaces are smooth, and they are prevented from rolling about in the bladder, and the weakened muscular fibers of the bladder can not drive them forcibly out of the postprostatic pouch against the vesical orifice during the act of urination.

It sometimes happens that after hypertrophy begins the bladder wall, instead of growing weakened and atonic and ultimately becoming dilated, undergoes **hypertrophy with contraction.** In this condition the overgrowth of the prostate does not form an obstruction to the outflow of urine, and residual urine does not accumulate, and the bladder, instead of being distended and enlarged, undergoes a *diminution in the size of its cavity,* so that it may only contain six or eight ounces of urine when fully distended.

In addition to the contraction of its size there is also a permanent congestion of the vesical neck from pressure on the veins, by the enlarged prostate. This venous engorgement occasions an extreme irritability of the bladder, with an almost constant desire to urinate.

Of the two conditions spoken of, the patient with an atonied, relaxed bladder which does not cause him trouble, even though it is incapable of emptying itself except by catheter, suffers far less inconvenience than the man who has an hypertrophied, irritable bladder, and is tormented continually with an intolerable desire to urinate.

**Changes in the Kidneys and Ureters.**—As the obstruction offered by the prostate increases, a greater amount of muscular effort is required to empty the bladder.

As a result the amount of residual urine has been increasing and there has been a back pressure which dilates the ureters and extends up into the pelves of the kidneys.

This pressure has come on so gradually that the patient has become accustomed to it.

In some instances there are apparently no organisms in the urine though the infection probably exists in the tissues at the time.

A sudden removal of all the residual urine, immediately takes away all the back pressure.

This would not be serious so far as the bladder and ureters are concerned, but in the pelves of the kidney it makes a negative pressure so that the blood vessels and tissues of the kidneys, which were compressed, are released and more blood flows into the kidneys than was there while the pelves were distended.

It is probable that in this way sudden relief of the back pres-

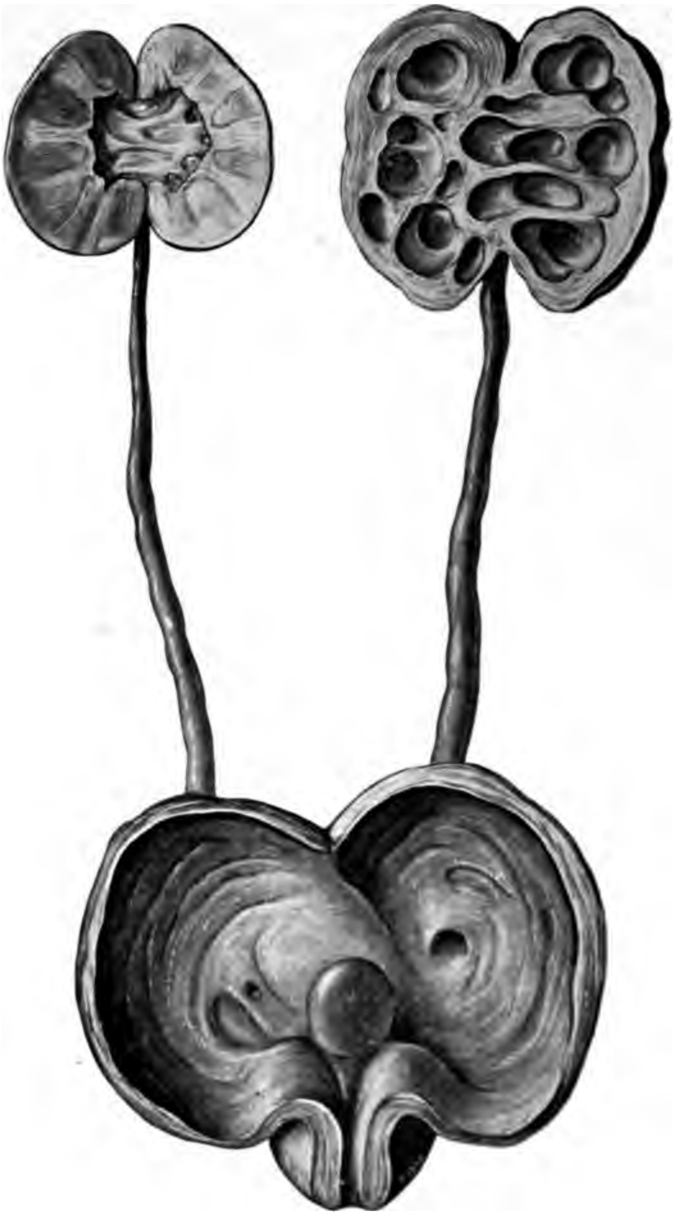

Fig. 198.—Hypertrophy of prostate. Intravesical enlargement of middle lobe, giving ball-valve effect. Dilatation of left ureter and pyonephrosis of left kidney.

sure induces an acute hyperemia of the kidneys which results in acute nephritis, suppression of urine, and death.[7]

In addition to the chronic congestion of the kidneys, the long-continued distention of the pelves often gives rise to hydronephrosis and the calices of the pelves of the kidneys may become dilated to an enormous extent.

In course of time, the kidneys become infected with microorganisms and a new element, pyelonephritis, is added to the case.

It is not known positively how the organisms reach the kidney from the bladder. Cabot believes that they are carried through the general blood circulation to the kidney, while Eisendrath[8] thinks they pass upwards through the lymphatics of the ureters, but the general view is that **ascending infection** takes place by the bacteria making their way upwards in the column of stagnant urine, lying within the lumen of the dilated ureter, into the pelvis of the kidney.

Having settled upon the walls of the pelvis of the kidney and set up a pyelitis, the organisms make their way into the substance of the kidney and cause small multiple abscesses in its cortex. General pus collections may coalesce so that they reach the size of a pea and bulge on the surface.

This is the so-called suppurative nephritis to which is always added an inflammation of the pelvis of the kidney, or pyelonephritis, and when the pathologic changes have reached this point, death is practically inevitable.

### Symptoms

The clinical picture which an old man with hypertrophied prostate presents is a result of all the anatomic changes described and presents great diversities.

For a better understanding of the subject it is convenient to adopt the classification of Guyon and divide the course of the disease into three stages:

**First Stage, or Premonitory Period.**—The first symptom noticed is a slight difficulty in starting the flow of urine and a deficiency in the force of the stream, so that, instead of being projected forcibly, the stream trickles to the ground, wetting his shoes. Frequent calls to urinate are always present and usually the first thing to call the patient's attention to his condition. In addition to the venous congestion of the prostate and trigone a reflex polyuria is usually present and the nocturnal urination is accounted for by these two elements.

If the bladder is examined at this time with the catheter, no residual urine is present and it can empty itself completely.

**Second Stage, or Insufficiency of the Bladder.**—Slowly, often after several years, the first stage gives place to a condition of partial retention of urine; the frequency of urination increases and the patient has the unsatisfied feeling after urination which follows only a partial evacuation.

If the catheter is introduced after urination, a considerable quantity of residual urine will be found remaining in the bladder.

The second stage may last for several years if the patient conducts himself circumspectly, but the residual urine slowly increases in amount as the muscular force of the bladder fails and ultimately a state of complete retention begins.

**Third Stage, or Period of Incontinence.**—At this time the distention of the bladder has reached an enormous degree, often palpable as a fluctuating tumor extending as high as the umbilicus and containing as much as two to three quarts of fluid.

The desire to urinate may occur every five or ten minutes with the passage of a few drops of urine, or the urine may flow involuntarily from the patient almost without his knowledge, and if asked if he can pass his water he usually answers that he passes it too freely. (See Paradoxic Ischuria.)

As the backward pressure upon the ureters and kidneys becomes greater, constitutional symptoms make their appearance, particularly in old and feeble men.

The symptoms are all referred to the digestive tract and consist in loss of appetite, flatulence, constipation, and dyspepsia. The tongue is rather characteristic of the condition, and is dry and brown, and the patient emaciates slowly and if the temperature is taken a slight evening rise is noted.

He is drowsy all the time, and his mind has lost its former alertness.

The condition is one of toxemia, and is due to the absorption of toxic material from the urine and retention of waste products which the damaged kidneys are not able to excrete. If cystitis has not begun the avenue of entrance into the blood is through the pelvis of the kidney, which is distended with urine, but if the bladder wall is congested and eroded, part of the absorption may come from this organ as well as the kidneys, and is a true urosepsis.

### Complications of Senile Prostate

Retention of urine occurs in nearly every case of enlarged prostate, and presents itself in two forms:

(*a*) *Acute Retention.*—This occurs suddenly in an individual who up to the time had been able to pass water with a fair degree of freedom. It is frequently brought on by chilling or wetting the surface of the body and taking cold. The sudden congestion of the mucous membrane around the vesical orifice causes it to swell up and occlude the opening entirely, in the same way that a cold in the head will close up the nasal passages.

On the other hand, the retention may be occasioned by a spasmodic contraction of the cut-off muscle (spasmodic stricture), which occurs as a reflex from constipation and scybala in the rectum, or an acid condition of the urine from overindulgence in wine or malt liquors.

After the retention has been relieved and the patient catheterized for some days, the ability to urinate is generally partially restored, but it is rather unusual for such a case to be able to dispense entirely with the catheter subsequently, and he enters upon the second stage of his disability.

(*b*) *Chronic retention,* as already described, is caused by the obstruction at the vesical outlet from the enlarged prostate and partly induced by the atonic condition of the muscular walls of the bladder.

*Cystitis* is the most common complication, and few prostatics are able to avoid it, for the condition of residual urine and passive congestion are favorable for its development.

It often results from instrumentation, or it may develop from the entrance of colon bacilli from the rectum, often appearing as an acute cystitis which becomes chronic. Under appropriate treatment a chronic cystitis improves considerably, but it is rare for it to clear up entirely.

*Vesical calculi* are very liable to form in the presence of cystitis, especially in untreated cases.

*Pyelitis* and *pyelonephritis,* with their influence upon the general condition and their effect in causing urosepsis, have already been described.

*Hematuria* is often observed and comes from the varicose veins underneath the mucous membrane, which develop as a result of the pressure of the enlarged prostate upon the venous plexus of the bladder. Usually it is not alarming, but exceptionally may be so severe as to fill the bladder with clots, which, if they can not be washed out through a litholapaxy evacuator, may require a suprapubic cystotomy to evacuate the clots and control the hemorrhage.

*Epididymitis* occurs very often as a result of the frequent use of the catheter. The inflamed testicle rarely suppurates, but becomes indurated and is liable to exacerbations of the inflammation.

## Diagnosis

In the case of a man over 50 years of age, complaining of difficulties of urination, enlarged prostate should always be suspected.

It is desirable to conduct the examination systematically, and to that end

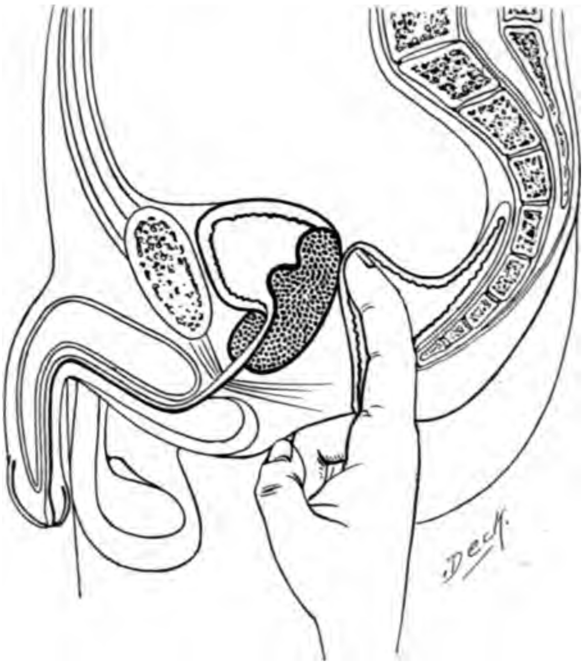

Fig. 199. – Senile hypertrophy of prostate; finger in rectum can not reach upper margin of prostate; suprapubic prostatectomy is operation of choice.

**I. A rectal examination** should be made, to feel the prostate and judge of its size and consistency and to determine, if possible, whether the enlargement is fibrous or glandular in character.

Of course, only the posterior portion of the gland can be felt through the rectum, and it is impossible to determine the shape of the obstructing overgrowth in this way, but its density and the extent of the enlargement of the entire gland can be determined by the rectal touch.

**II. The quantity of residual urine** should be collected and measured after the following method: The patient is requested to pass water, and endeavors to empty the bladder completely. A **catheter** is then introduced into the bladder, and all the urine which remains behind and which the patient has been unable to void spontaneously is known under the term "residual urine." The residual urine should be measured and set aside for microscopic examination.

The *quantity* of residual urine indicates the extent to which the prostatic enlargement interferes with the complete emptying of the bladder; but in order to determine the *shape* of the outgrowth which projects up into the bladder and blocks its outlet, we must have recourse to the cystoscope.

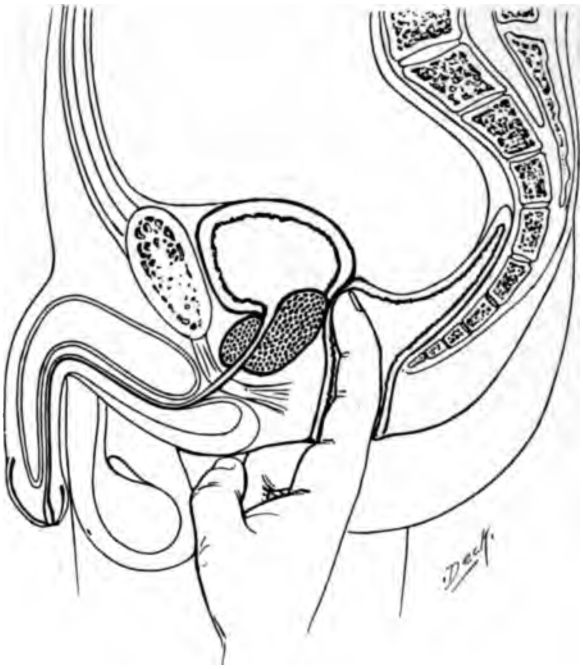

Fig. 200.—Senile hypertrophy of prostate; finger in rectum easily reaches and outlines upper margin of prostate; suitable for perineal intraurethral enucleation.

At the time of collecting the residual urine we can also determine the *length of the urethra* by measuring the distance from the eye of the catheter to the point upon its shaft to which it is necessary to introduce it before the urine begins to flow. This measurement often fails to demonstrate an existing enlargement, as a decided amount of obstruction may be present which causes but very little elongation of the urethra.

III. By means of a **cystoscopic examination** it is possible to see the enlargement of the middle lobe projecting upward, and to some extent to see a lateral lobe, if it impinges upon the vesical outlet. As the cystoscope is introduced through the urethra it will also serve to exclude the presence of a *tight stricture,* and by its use in the bladder we can prove the presence or absence of *vesical calculus,* which is so apt to be present in cases of enlarged prostate with residual urine.

**IV. Functional Activity of the Kidneys.**—In every patient with hypertrophied prostate where operation is contemplated, the functional activities of the kidneys should be ascertained by means of the phenolsulphonephthalein test before any surgical procedure is advised. Many a patient of fairly healthy appearance has been sent to his grave, because the surgeon did not know beforehand whether his kidneys would stand the strain of operation at that particular time, whereas with proper preliminary treatment, the secreting capacity of his kidneys could have been so that the prostatectomy could have been done with safety and success.

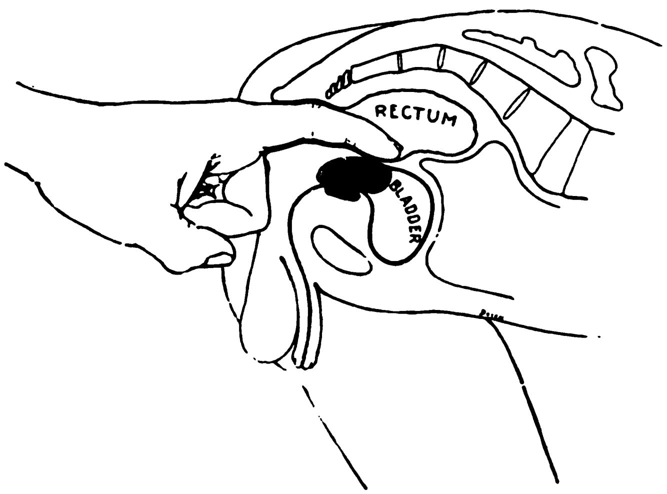

Fig. 201.—Senile hypertrophy of prostate. Finger in rectum easily reaches and outlines upper margin of prostate. Suitable for perineal intraurethral enucleation.

There are certain **precautions to observe** in every examination of prostatic cases: The patients are old men whose vitality is low and who are more or less feeble. Their urinary passages are in an irritable condition, and they are very liable to *urinary fever,* and any prolonged or rough examination is apt to be followed by **chills, fever,** and constitutional disturbances. For these reasons the i ments should be aseptic, and when practicable it is desirable to cleanse the urethra and bladder by irrigation before instrumentation.

The instruments should be used with extreme gentleness to avoid any traumatism, which would allow entrance of microorganisms into the circulation, and the first examination should not be too prolonged.

It is desirable that the patient should be examined for the first time in his own home, so that he can go to bed at once after the examination, and thus avoid the necessity of going out of doors, running the risk of chilling the body.

**The irrigation urethroscope of Wossidlo** gives a good view of the posterior urethra and discloses any tumors or prominences which project into it.

**A distended bladder** should never be emptied at one sitting, and many an old man has met his death at the hands of a well-meaning practitioner armed with that deadly, but silent weapon of offense, the catheter. Drawing off the entire contents of the bladder at once, relieves the back pressure upon the pelves of the kidneys too suddenly. Acute congestion of the kidneys follows, the secretion of urine becomes scanty and ultimately suppressed, and within a week after the first introduction of the catheter the patient is dead of anuria.

In case a man has sound kidneys, and is not too feeble, he may escape with a severe cystitis.

If the bladder has been considerably distended for a long time and contains one or two quarts of urine, only a part of it should be withdrawn at one time, or if by accident all the urine has escaped through the catheter 8 or 10 ounces of boric acid or normal salt solution should be injected and left in the bladder.

### General Treatment

In all cases of prostatic hypertrophy **hygienic measures** are very important in preventing attacks of retention of urine. The patient should wear flannel underclothing in winter, and, as the circulation of blood is poor in the feet and these parts are most easily chilled, woolen stockings should be worn.

He should avoid any overindulgence in alcohol or malt liquors, although a glass or two of claret or a little whisky may be permitted.

The bowels ought to receive due attention, and constipation should be guarded against. Any overdistention of the bladder with retained urine has the effect of still further weakening the atonic muscular walls, and on this account the patient should be instructed to pass his water at regular intervals, two to four hours apart.

In the early stages of prostatic hypertrophy, when the enlargement is only moderate in size and not very dense, and when the quantity of residual urine is small, the chief source of annoyance to the patient is from the irritabilty of the bladder, which causes a frequent desire to urinate.

Such cases are often benefited by the passage of a **large-sized steel sound,** which relieves the irritability of the bladder and overcomes the muscular spasm of the urethra. The action of the sound is to press out and empty the engorged venous plexus around the prostate, and, while it does not prevent the increase in size of the gland, it seems at least to retard its growth. The sound should be used once in every five days, and allowed to remain lying in the urethra from ten to fifteen minutes at a time. The sound also lessens vesical irritability, causes the quantity of residual urine to become less, and modifies favorably the whole course of the case.

The treatment with sounds is only applicable to patients who have a slightly enlarged prostate of moderate density, which does not obstruct a catheter and where but little residual urine is present. The prominent symptoms of which these individuals complain is the necessity for getting up once or twice at night to urinate.

R. H. Greene[5] advises dilatations of the posterior urethra by means of Kollmann's four-bladed dilator in the early stages of prostatic hypertrophy, with the object of breaking up the submucous infiltration caused by the prolonged urethritis. In this way the mouths of the prostatic ducts are freed and the glandular secretion is afforded a means of exit.

The presence of **residual urine** offers an important indication for treatment.

If the residual urine is only one or two ounces in quantity and clear in color, it is only necessary to pass the catheter once in four to eight weeks, in order to observe the progress of the case and ascertain that the obstruction is not becoming greater or the atony of the bladder wall increasing.

In time, however, the residual urine increases in amount, and when it reaches three or four ounces in quantity the catheter should be employed once a day to remove it from the bladder, a convenient working rule (if the urine is sterile) being to use the catheter once daily, preferably at bedtime, for 3 ounces, twice daily for 6 ounces, and then once more for every additional 2 ounces. With sterile urine it is rarely necessary to catheterize oftener than once in four hours.

Unfortunately, however, the bladder rarely escapes infection for any length of time after beginning catheterization, and then a new element is introduced into the case: that of **cystitis.** Inflammation of the bladder is generally ushered in by some rise in temperature, which may run for a few days and subside, or may continue for some length of time as a result of absorption of septic material into the blood.

The frequency of the desire to urinate is notably increased, and the urine contains pus, and in the early stages blood may be present.

The fermentative changes in the urine rapidly cause its decomposition, and it becomes strongly alkaline in reaction and ammoniacal in odor.

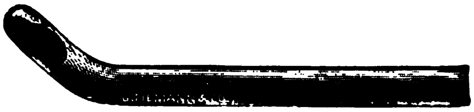

Fig. 202.—Mercier catheter coudé.

After cystitis has lasted for a short time the contractility of the muscular fibers of the bladder walls is still more impaired, and the residual urine increases in quantity, so that the catheter has to be used more frequently, in order to prevent the accumulation of urine, which is stagnant and soon decomposes.

The indications for the treatment of this condition may be summed up as follows:

(*a*) Drain the bladder of residual urine.

(*b*) Keep it as clean and aseptic as possible, and check decomposition of the urine by means of bladder washing and the administration of urinary antiseptics by the mouth.

For the treatment of the cystitis the reader is referred to the chapter on the treatment of chronic cystitis.

The ordinary routine treatment of a case of prostatic hypertrophy, consisting in **bladder washing and daily catheterization,** can be readily carried out by the patient himself, if he is moderately intelligent, after he has been instructed by his attending physician.

The best form of catheter for him to use is the soft-rubber instrument, and, indeed, every patient with enlarged prostate should be familiar with the method of passing the catheter and should keep one at hand, as he is always liable to an attack of retention of urine from some slight cause, and unless prompt relief can be obtained the bladder wall may suffer irreparable damage from the distention and stretching caused by the accumulation of urine.

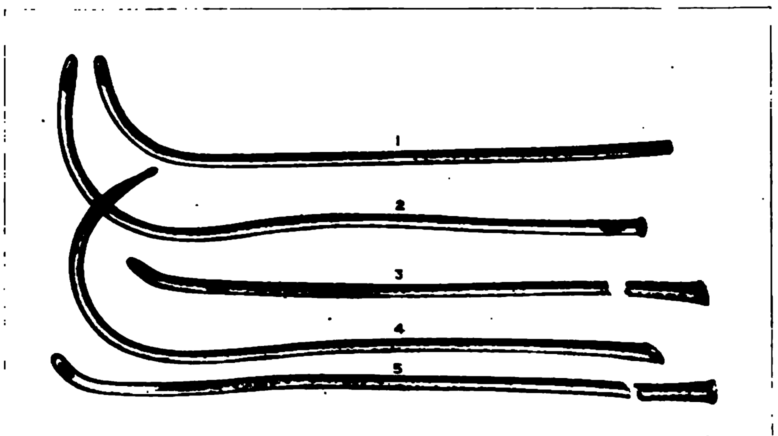

Fig. 203.—Prostatic catheters.

An important part of the instruction of the patient consists in teaching him the proper method for the **care of the catheter.** This is a very material point in the management of the case, and, if cystitis is not already established, the frequent use of the catheter generally induces it, unless the greatest care to avoid infection is taken by means of scrupulous cleanliness.

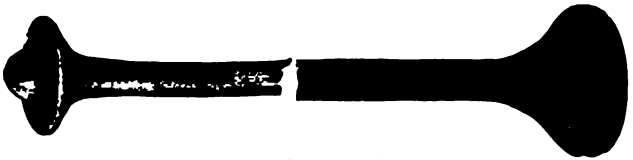

Fig. 204.—Pezzar catheter.

It is not difficult to cleanse the outside of the catheter, but the interior is its most dangerous part, on account of the difficulty of disinfecting it. (See chapter on Care of Urethral Instruments.)

In every case the catheter should be frequently inspected, and discarded at once when it becomes dry and cracked.

At the time the patient is instructed as to taking care of his catheter he should also be taught to wash the glans penis with a cotton sponge and soap and water, every time before the catheter is introduced, in order to avoid carrying microorganisms into the urethra from the head of the penis.

But in spite of all precautions, it is most exceptional for the urine to remain clear, and, as a rule, a slight degree of cystitis is continually present. On this account and to lessen the tendency to the formation of calculus, it is very desirable that the patient use **irrigation of the bladder** once or twice each day.

This can be very readily done, at the time he uses the catheter, by means of a rubber douche bag or fountain syringe raised up three feet high and attached by its tube to the end of the catheter. The mild solutions, either boric acid, salt solution, or permanganate of potassium, or oxycyanide of mercury are suitable for this purpose.

**Commencement of Catheter Life.**—In cases of prostatic hypertrophy where there is little or no cystitis and the quantity of residual urine is only from 4 to 6 ounces, if due precautions are taken to guard against cystitis, the patient very soon becomes accustomed to the use of the catheter. But, in those instances where the residual urine amounts to 10 ounces or more, a considerable amount of *constitutional disturbance* usually follows the first catheterization. Urinary fever generally occurs, and, if the kidneys were previously diseased and the patient is very old and feeble, it is by no means rare for the case to terminate by death.

It is desirable, then, before beginning catheterization, in the presence of *large quantities* of *residual urine,* to warn the patient that there is some risk attached to the procedure, and to insist that he shall remain quietly at his home and for the most part in bed for a fortnight. During that time the urine should be drawn by the catheter, three or four times a day, not emptying the bladder completely, but always leaving several ounces of urine in the bladder to distend it.

It requires about a week to empty a bladder completely. At the end of that time, if the quantity of residual urine has been reduced each day, it will usually be found that the bladder can be emptied entirely at each catheterization.

Urinary antiseptics should be given by the mouth, but it is better to avoid washing out the bladder for the first week or so, until a certain degree of tolerance is established. Under these precautions the advanced cases of prostatic hypertrophy with an excess of residual urine are introduced into catheter life with a minimum degree of risk. But even in spite of all care patients who are old and feeble, and are suffering from chronic Bright's disease or pyelitis, sometimes develop a chronic form of urinary fever, induced by the beginning of catheter life, which terminates fatally.

In these instances death would have resulted from the kidney disease in any case, after a short time, and had the use of the catheter been commenced at an earlier period in the disease the secondary involvement of the kidneys would have been avoided.

**Acute Retention of Urine.**—Most old men with enlarged prostates suffer at some time in their lives with an attack of acute retention of urine, from spasm of the cut-off muscle and swelling of the mucous membrane at the vesical outlet. Such a condition calls for *prompt catheterization.* The use of prolonged hot baths and a full dose of opium, which so often relieves a spasmodic stricture in a young man, is not to be recommended in retention of urine from an enlarged prostate. The overdistention of the bladder must be relieved at once, as the stretching of its muscular fibers induces a condition of atony.

The form of *catheter* to be selected depends upon the shape which the overgrown prostate has assumed. It is often found impossible to introduce a flexible soft-rubber catheter, and it is necessary to try various shapes, until one is found which will override the obstruction offered by an enlarged middle lobe, or an adenomatous tumor which deflects the urethra to one side.

The form of catheter which is most frequently serviceable is the *Mercier catheter,* with the end turned up (coudé). The angled end usually slips up past an enlarged middle lobe and enters the bladder. The catheter bicoudé acts in a similar manner and is useful when the overgrowth of the middle lobe is excessive.

The *silver prostatic catheter,* with a long beak and an exaggerated curve, is especially designed to fit the elongated sweep of the urethra distorted by the prostatic overgrowth, and is frequently successful in reaching the bladder. When it fails to enter the bladder the following manipulation is often successful: The surgeon has provided himself beforehand with a common English catheter with a stylet, which has been previously prepared by giving it an exaggerated curve, and it is then laid away until needed. When it is wanted, the stylet is withdrawn and the catheter is introduced into the urethra. The warmth of the body causes the curve to increase, and the point of the instrument overrides the obstruction. The catheter may also be introduced with the stylet in it down to the prostatic urethra. When it reaches this point the stylet is withdrawn and the point of the instrument curves around the enlarged prostate.

In the manipulations with the silver and English catheters due care should be used not to make a *false passage* in the swollen tissues around the prostate. The attempts to reach the bladder with a filiform guide and a tunneled sound threaded over it are of very little use except in cases of stricture.

A bladder which is full and distended, if it has been so for more than a few hours, should *never be completely emptied at one sitting,* but 6 or 8 ounces of urine should be left in it, to support the blood-vessels and give the muscles something to contract on.

If all attempts to enter the bladder are unavailing, in order to relieve the retention it is necessary to have recourse to **suprapubic aspiration of the bladder.**

The needle attached to the aspirator is thrust directly downward, a finger's breadth above the pubes, and penetrates the bladder without wounding the peritoneum, as when the bladder is distended the fold of peritoneum covering it is raised up two and one-half inches above the pubes.

Aspiration affords prompt relief; but, while the bladder has been emptied for a week by means of repeated aspirations, it can not be done with safety more than a few times.

Suppuration often results after three or four tappings, or the bladder wall becomes soft and leaks; so that aspiration can only be depended on as a temporary expedient, for a day or two.

In certain cases of enlarged prostate which are suffering from chronic retention, it is desirable to keep the bladder empty and at the same time avoid the frequent introduction of a catheter; to attain this end **continuous catheterization** is accomplished by introducing a soft-rubber, woven silk or Pezzar catheter into the bladder and tying it, so that it can not be forced out.

The indications for the use of continuous catheterization are summarized by J. W. White as follows:

(*a*) When great difficulty is experienced in introducing the catheter.

(*b*) When much bleeding follows the introduction of the catheter, as is generally the case when unsuccessful attempts at catheterization have been made before.

(*c*) When much cystitis with purulent or ammoniacal urine exists and the frequent passage of a catheter is impracticable on account of the pain and hemorrhage which it produces.

(*d*) As a preliminary to any form of prostatectomy when much residual urine is present in the bladder.

By means of continuous catheterization, the bladder is drained and readily washed out, and a general improvement in the symptoms takes place.

A metal catheter should, of course, never be left in the bladder, for a sudden motion of the patient may force the end through the bladder wall. Such a wound is followed by leakage of urine, peritonitis, and death.

An ordinary woven silk or Mercier catheter may be tied in the bladder, or the Pezzar catheter may be employed with advantage, as it is not easily withdrawn, except intentionally, and the spreading end holds it in place without the necessity of tying it fast.

In order to introduce the catheter, a stylet is passed through its lumen, straightening out the mushroom-shaped dilatation at the end. When the catheter is in the bladder the stylet is withdrawn, and the mushroom expansion reappears, and by its projection holds the catheter in place.

## BIBLIOGRAPHY

[1] **Lowsley:** Ann. Surg., Dec., 1915.

[2] **Smith, E. O.:** Jour. Am. Med. Assn., Dec. 6, 1913.

[3] **Ciechanowski:** Mitteil. a. d. Greuz gebieten d. Medizin u. Chirurgie, 1900, vii; English translation by Robert Holmes Greene, published by E. R. Pelton. 1903.

[4] **Greene and Brooks:** Nature of Prostatic Hypertrophy, Jour. Am. Med. Assn., April 26, 1902.

[5] **Greene and Brooks:** Diseases of the Genitourinary Organs, ed. 4, 1917.

[6] **Kielleuthner:** München. med. Wchnschr., Aug. 5, 1912.

[7] **Judd, E. T.:** Interstate Med. Jour., 1917, xxiv, 70.

[8] **Eisendrath, Daniel:** Jour. Am. Med. Assn., Feb. 19, 1916; Tr. Am. Urol. Assn., 1916-1917. Watson, F. S.: Hypertrophied Prostate, 1888. Lewis, Bransford: Jour. Cut. and G. U., July, 1902.

## CHAPTER XXVII

# OPERATIVE TREATMENT OF HYPERTROPHIED PROSTATE

Until within a comparatively few years the operative treatment of hypertrophied prostate was in the experimental stage, as may be seen by the accompanying table of operations in vogue.

A list of the operations may be tabulated as follows:

**Radical Operations.**—

Bottini's Operation.
Prostatotomy { Perineal. / Suprapubic.
Prostatectomy { Suprapubic, / Perineal, or / Combination of both.
Vasectomy.
Castration, or Orchidectomy.

**Palliative operations,** in which no part of the prostate is removed, are only undertaken for the purpose of draining the bladder through a fistulous opening:

(*a*) Perineal cystotomy and drainage through a catheter retained in the bladder.

(*b*) Suprapubic cystotomy.

(*c*) Puncture through the substance of the prostate with a trocar.

### History of Operations on the Prostate

In order to understand clearly the present status of the surgery of the prostate, it is necessary to go back and study its gradual growth.

The operation of **prostatectomy** was not evolved in a night, but was a thing of slow development, each observer adding something to the sum of our knowledge.

The earliest attempt at operative interference with the prostate was a simple incision, or ***prostatotomy,*** through the **perineum,** in which a middle lobe was divided in halves, or a V-shaped piece was cut from the prostate in order to get a low-level channel from the bladder.

It was found that when the prostate was not more than three inches thick it was possible to reach a projecting median lobe through an incision in the perineum.

Once within reach, the lobe could be readily divided with a knife, or if it was nipple-shaped it could be nipped off with scissors or an ecraseur.

It was, however, found to be rarely possible by means of a simple prostatotomy to remove enough of the overgrowth of prostatic tissue to relieve the symptoms of obstruction, and the chief advantage which followed was from the benefit the patient derived from the prolonged drainage of the bladder through a catheter and the consequent improvement of the cystitis.

In 1888 a great impetus was given to prostatic surgery by two operations of McGill, of Leeds, England, who removed, through a suprapubic incision, portions of the prostate. These growths were chiefly intravesical projections, and were removed by cutting with scissors and tearing off with forceps. The suprapubic wound was subsequently utilized for bladder drainage.

In 1890, Belfield, of Chicago, advanced the technic of prostatectomy by operating through a *combination of suprapubic and perineal* incisions. In this way easier access was afforded to the prostate, and he removed the growths by enucleation, instead of cutting and tearing them off. In these operations the prostate was enucleated through the suprapubic wound, and the perineal wound was utilized for drainage.

The hemorrhage was always considerable, and often alarming, and the bleeding could only be controlled by packing not only the cavity in the prostatic capsule, but the bladder as well.

The mortality of suprapubic prostatectomy remained at a very high rate, in the cases reported reaching 20 per cent; but if all the deaths were known the death rate would probably be much higher.

In 1895, Eugene Fuller, of New York, published an account of an improved technic for suprapubic prostatectomy with a report of 6 cases operated upon, and, in 1900, Freyer, of London, described practically the same operation, but took to himself all credit for originating it, although the details of Fuller's operative method had been described to him previously by Dr. Ramon Guiteras, of New York.

The *perineal operations* have, in the same way, been worked out by different surgeons step by step.

The first surgeon to describe the technic of enucleation of the prostate by the finger through a perineal incision was J. W. S. Gouley, of New York, in 1873, but to Bryson, of St. Louis, in 1898, and Alexander of New York, should be given the credit of applying the technic of the perineal operation for the relief of a large number of prostates, with a low rate of mortality.

The dissecting operation by which the prostate is exposed by a transverse incision and enucleated under the guidance of the eye developed on the continent of Europe, more particularly at the hands of Albarran (first publication in 1901), and was further greatly facilitated by the application of a tractor for drawing the prostate down into the wound by Hugh Young, of Baltimore, in 1903.

The former high rate of mortality in prostatectomy led surgeons to seek for other means of removing the obstructing prostate.

In 1893, J. William White, of Philadelphia, first published the results of his experiments, showing that the removal of both testicles in animals caused an atrophy and shrinking of the prostate, and in the same year Ramm, of Christiania, reported similar results.

Velpeau and Sir Henry Thompson called attention, years ago, to the similarity between the fibromyomata occurring in the prostate and those of the uterus. Following up this suggestion, White castrated a number of dogs, and found that the operation was in every case followed by a rapid atrophy, first of the glandular structures of the prostate and then of the muscular elements.

Since then it has been frequently demonstrated that, while **double castration** causes an atrophy of the prostate in animals, it does not cause a reduction in the size of the tumors which occur in hypertrophied prostate in men. It does, however, occasion a decrease in the congestion of the gland, and in this way the urinary obstruction was temporarily relieved in some cases. For a time the operation had a good deal of popularity, but today it is no longer in use and has been abandoned.

At the time castration was practiced, the disinclination of patients to allow the removal of their testicles led surgeons to attempt to cause an atrophy of the prostate by means of **vasectomy,** or ligating the spermatic cord through an incision in the scrotum.

Experiments on animals show that, when the spermatic cord is divided, the prostate sometimes grows smaller. The decrease in size is accounted for by a lessening of the congested condition of the gland which takes place immediately after the operation.

Albarran and Motz, from their studies of the subject of vasectomy, conclude that resection of the vasa deferentia is often followed by a lessening of the congestion of the prostate, which causes its volume to diminish temporarily, and evokes an improvement of the dysuria, the cystitis or the retention from which the patient suffers.

There is nothing to prove that the operation causes an atrophy of the hypertrophied prostate, or that in cases of chronic incomplete retention the residual urine is diminished, if the operation is made at a time when the prostate is not congested. There are also no records to show that after the operation the bladder is able to empty itself.

Casper believes vasectomy may be useful in two classes of cases:

(*a*) In old men who are dependent on the catheter and who are subject to repeated attacks of epididymitis.

(*b*) In patients with slightly contracted bladders and no residual urine, but who suffer from an uncontrollable, constant, and severe tenesmus.

Casper accounts for its beneficial effects in these cases not by reducing the size of the prostate, but by severing the nerves of the vas deferens, which are in an irritable condition.

Except in such cases as just mentioned, vasectomy has been abandoned, and the only operations in use today for the radical cure of hypertrophied prostate consist in prostatectomy and very exceptionally Bottini's operation.

### Preliminary Treatment Before Operation

The great factor in the reduction of the operative mortality of prostatectomy is a *suitable preliminary treatment* instituted to ward off the most frequent cause of death afterward, viz., *suppression of urine.*

This arises from an acute congestion of the kidneys, often superimposed upon an old kidney lesion, and results from the too sudden emptying of the bladder and relief of the back pressure.

To avoid this it is necessary to withdraw the urine gradually from the bladder, requiring perhaps a week in a case of great distention for the bladder to be completely emptied. It is found that a sudden withdrawal of the intravesical pressure will throw the kidneys into a condition of acute congestion, and if they are partially disabled the sudden change may result in acute nephritis and suppression.

**Preliminary Drainage.**—After the bladder has finally been emptied of urine, it must be kept empty until such time as the phenolsulphonephthalein test shows that the kidney function is sufficient to support life after the added strain of a prostatectomy.

The author prefers to keep the bladder empty by means of a catheter tied in the urethra and retained for one or more weeks until the phthalein test is satisfactory. The permanent drainage should be supplemented by bladder washings and instillations of 5 per cent argyrol and the catheter be removed every three or four days and the urethra "rested for a few hours."

With a reliable index to the capacity of the kidneys, the suitable time for operation can be selected and it is not necessary to have recourse to the blood nitrogen and creatinin test to decide the proper moment.

Most patients can be drained perfectly well with a catheter retained in the urethra; in some instances one is encountered who is intolerant to the catheter. In such cases recourse may be had to the two step prostatectomy which consists in establishing bladder drainage through a suprapubic incision until such time as it is considered safe to do a prostatectomy.

The writer deprecates this method of preliminary drainage and only uses it when a catheter can not be retained in the urethra. The objections to a preliminary suprapubic incision for drainage are that the wound often becomes converted with a severe gangrenous phlegmon and the bladder becomes adherent to the peritoneum and all points around it, so that on enucleating the prostate the peritoneal cavity may be opened.

In addition to the preliminary drainage, water by mouth should be forced to stimulate the action of the kidneys and two to three quarts a day be given. Urotropin gr. xx three times a day is indicated as an antiseptic and if the urine is alkaline, acid sodium phosphate or benzoate of soda should be administered.

During the preliminary treatment it is important not to keep the patient in bed, but have him up and about as much as practical with his retained catheter.

Following the first establishment of drainage, in the presence of residual urine, there is a stage of renal depression as shown by a diminution in the 24-hour urine and phthalein output. This is the danger period through which the patient must pass, and it explains most of the deaths occurring within the first four or five days when prostatectomy has been performed without previously producing renal adjustment by drainage.

Under the effect of drainage and water the output of phthalein, if low at first, increases; and when the phthalein is 20 per cent or more in the first hour, it will be noted that the intake of water and the output of urine are nearly identical. These conditions may be attained after a few days of preliminary treatment, or it may require several weeks, but no operation should be undertaken unless the patient responds as described. In addition to the condition of the bladder and residual urine, careful attention should be paid to the state of the heart and arteries and valvular disease, myocarditis, and high arterial tension must be recognized and duly treated.

In cases of impending uremia, retention of acid salts in the blood may exist, causing acidosis. Sodium bicarbonate is called for in this condition either by mouth or intravenously and glucose by rectum always acts advantageously. In these cases free catharsis is always beneficial.

### Test of Kidney Function by Phenolsulphonephthalein

A method of testing the functional activity of the kidneys has been devised by Geraghty and Rowntree[1], which consists in noting the change in the color of the urine after the subcutaneous injection of **phenolsulphonephthalein** (prepared by Hynson, Westcott & Dunning, of Baltimore). The test is made by emptying the patient's bladder completely and 1 c.c. of the standard solution of the drug injected into the muscles of the back.

At the end of one hour the entire contents of the bladder should be carefully collected, and the amount of the drug secreted accurately estimated by a colorimeter. Again, at the end of the second hour, another such collection and similar examination should be made.

As to the value of the phenolsulphonephthalein test the author quotes at length from Dr. Geraghty's article:

"The phthalein test has given valuable information in all these cases and has enabled us to differentiate those cases with severe renal damage from those in which the renal involvement is slight. As a rule the test has demonstrated the greatest impairment of function in those cases which have large residual urine and have not been leading a catheter life. Clinically, this type of case is recognized as the most dangerous when operation is undertaken without preliminary treatment. In many instances in which the output of the drug was low when the patient was first seen, the adequate *régime* described above has resulted in a decided improvement of the kidney function as indicated by the test.

"When the time of appearance is delayed beyond twenty-five minutes and the output of the drug is below 20 per cent for the first hour, operation is postponed regardless of the patient's clinical condition. If under routine treatment the output remains low but constant, the renal function is probably in a stable condition, and the operation may be undertaken, care being taken to select an anesthetic which will not further depress the renal function. In one instance a successful operation was performed with an output of 8 per cent for the first hour, but this output had remained constant for a period of five weeks. The low output here was ascribed to chronic interstitial changes in the kidney, and nitrous oxide was accordingly employed.

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[1] Jour. Pharm. and Exper. Therap., July, 1910

"When the residual urine is large and the patient has not been leading a catheter life, even if the output at a single determination is large, operation is deferred in order to determine whether the functional activity is stable, for it has long been recognized that following the relief of retention the function of the kidney is extremely variable. Repeated determinations should be made, and, except when unavoidable, operations should not be performed when the tests indicate a decreasing function. There have been two such cases in our series, in both of which operation was followed by death from acute suppression. Again when only a trace of dye is excreted, operation should not be attempted, as grave renal changes exist. Two cases excreting only a trace died of uremia within a short period. In neither case was any operation performed, though clinically at the time of the first test no evidence of uremia was detected."

### Causes of Death After Operation

Suppression of urine is the cause of the greater number of deaths after any form of prostatectomy, but since the adoption of preliminary drainage before, and the Murphy drip after, operation a great reduction in the mortality from this cause is noted.

Shock following the operation ought seldom, if ever, to be met with if a rapid operation with a minimum quantity of the anesthetic is used.

Hemorrhage should be watched for and the nurse ought to be constantly on the alert for this complication, which if discovered in time can always be controlled. In the case of suprapubic prostatectomy, it may be necessary to tampon the entire bladder with gauze for forty-eight hours, and in perineal cases removal of the tube, clearing the clots out of the bladder, reinserting the tube, and repacking the wound around it will always control the bleeding.

Pulmonary embolism is not uncommon, and is probably due to the dislodgment of a septic clot from the pelvic plexus of veins which is carried to the lungs.

Gangrene of the suprapubic wound and general sepsis after the high operation occasionally occur, and are due to the constant contact of the foul urine with the extensive abdominal wound after the drainage tube is removed.

Another cause of death to which a name can hardly be assigned is rather common in very old and debilitated subjects, and seems to be due to a general and gradual failure of all the vital powers. The kidney secretion remains free and there is no rise of temperature, but the patient loses his ability to take food, his strength fails, the wound remains sluggish without a tendency to heal, and the patient simply fades out of life, for no apparent reason except that he has reached the limit of his days and vitality.

## Late Complications

Incontinence of urine rarely follows the suprapubic operation, but is by no means uncommon after the median perineal enucleation, and is due to damage sustained by the cut-off muscle during the operation. It usually disappears after a few months as the muscle regains its tone.

Stricture of the divided prostatic urethra may occur unless sounds are regularly passed.

Cystitis generally persists for a time after the operation, but, as the bladder can be completely emptied, it is always amenable to treatment by bladder washing.

A suprapubic fistula may persist after the high operation, but generally closes if the granulations are curetted out, tincture of iodine applied to the fistulous tract, and the abdomen tightly strapped. A large-sized steel sound should be passed through the urethra once a week. In the event of these means failing, the patient should wear a permanent catheter for a week or two, and keeping the bladder empty in this way will always cause the fistula to close.

## Choice of Time For Operating

The improved technic and reduced mortality following radical operations for the removal of the prostate have placed the genitourinary surgeon in a very different attitude with regard to advising his patients at the present time from the position which was taken only a few years ago.

When a patient presents himself for treatment in the beginning of the second stage of hypertrophied prostate with only 4 to 6 ounces of residual urine, the bladder free from cystitis, and the kidneys unimpaired, the question arises, Shall we advise immediate operation or allow the patient to catheterize himself once or twice daily as long as he can maintain himself in comfort with the artificial evacuation of the bladder?

Two positions can be justly taken in answer to this question. In the great majority of cases the catheter affords only a temporary relief for a few months or years; cystitis and back pressure on the kidneys with increasing irritability of the urethra soon intervene, and when prostatectomy becomes unavoidable he is no longer the good operative risk that he presented at the commencement of his catheter life.

In the majority of cases after the catheter has been used for a long time, the prostatic hypertrophy increases in size, the contractile power of the bladder lessens, the cystitis grows worse, and the presence of a small quantity of urine in the bladder causes extreme tenesmus until it is removed. As a result of the frequent demands for urination, the catheter has to be passed so often that the urethra becomes irritable and bleeds freely, and the cystitis grows progressively worse. In the expressive words of J. W. White, the condition of the patient is that of "approaching breakdown in catheter life." These are all indications that catheterization must be discontinued and some other means of draining the bladder adopted.

Indeed, all of the surgical operations for prostatic hypertrophy are directed to the one end of *draining the bladder,* through the removal of the obstructing portion of the prostate.

The early operation is advised with the view of preventing infection of the kidneys and the deterioration of the patient's general health, on account of absorption from a septic bladder and the broken rest at night attendant upon frequent calls to urinate.

The prognosis of an operation is much better if done upon a man in good general health at the age of sixty than upon the same patient ten years later, after he has been worn out with suffering, and who has, in addition, diseased kidneys.

For hospital patients and those who have not the time or skill to give themselves and their catheters the proper attention, immediate operation is unquestionably preferable to temporizing. On the other hand, it is by no means unusual to see patients making themselves perfectly comfortable for years, sometimes in the presence of complete retention, by the use of a catheter.

With an intelligent man the author believes it better to explain the facts to him and allow him to decide for himself whether he wishes to be operated on immediately with a view of preventing the more serious condition which is almost sure to come later or to use the catheter and wait developments.

If the latter plan is adopted it is of the greatest importance that the patient should keep in close touch with the surgeon, and when it is found that the catheter must be passed more frequently, the urethra becomes irritable, and the cystitis is no longer easily controlled by the bladder washing the further delay of operation only imperils the patient's life and lessens the chances of the success of a prostatectomy.

## PROSTATECTOMY

On account of the development of the technic of prostatectomy by a number of different surgeons, there are today but three typical operations for the relief of enlarged prostate, each of which has its advantage in particular cases, and the surgeon of broad views will not invariably make use of one form of operation to the exclusion of the others, but from a careful study of the conditions will select the operation best adapted to the special case in hand.

An attempt has been made to formulate the indications for each type of operation, but before discussing this point it will be well to describe in detail the different forms of prostatectomy, viz.:

(*a*) Intraurethral enucleation of the prostate with the finger, through an external urethrotomy incision.

(*b*) Enucleation of the prostate through a suprapubic incision in the bladder.

(*c*) Exposure of the prostate through a transverse incision in the perineum, and enucleation of the prostate under the guidance of the eye.

As to the death rate after operation there is not much choice between the different forms.

In a series of 800 cases collected by Watson and Cunningham of perineal prostatectomy the death rate was 6.01 per cent. Freyer's personal statistics were 7.03 per cent, although these figures are somewhat lower than those of other suprapubic operators, while the Mayo brothers report 100 cases equally divided between suprapubic and perineal operations in one year with a mortality of 10 per cent.

The writer believes that ten per cent is a fair estimate of the number of deaths for any surgeon who is operating on a large hospital material, and who is forced to operate on a good many desperate cases that have been allowed to get into such a condition by previous neglect and lack of treatment.

The mortality statistics of a large number of private patients applying for relief early in the disease before they become broken in health and with damaged kidneys would probably range about 5 per cent or even lower. Hugh Young reports 128 consecutive cases without a death, but to get such excellent results a certain number of patients would have to be allowed to die without making the attempt to relieve them.

An interesting study of the statistics of prostatectomy was made by Tenney and Chase, who found that there is relatively more danger in operating on older men.

| CASES | AGES | MORTALITY, PER CENT |
|---|---|---|
| 120 | 50-60 | 5.8 |
| 422 | 60-70 | 9.5 |
| 240 | 70-80 | 15.0 |

In four London hospitals—St. Bartholomew's, University, Westminster, and Middlesex—the mortality from 1906 to 1910 was 21 per cent, while Freyer's mortality at St. Peter's Hospital for 1036 operations was 5.5 per cent. He began with a mortality of 10 per cent in his first 100 cases, which decreased to 3 per cent in his last 300 operations. It is evident that a mortality rate of 21 per cent shows that patients were operated on without due attention to the preliminary treatment so necessary before operation is attempted.

The first two named operations depend upon the anatomic fact that an adenomatous prostate, unlike a healthy gland, can be enucleated from a definite capsule surrounding it, the urethra being torn across during the enucleation, but without any harmful result, for the mucous membrane of the base of the bladder formerly serving as the roof of the prostate falls down and applies itself like a skin graft to the walls of the cavity previously occupied by the enucleated prostate.

The opponents of the first two forms of operation urge that the ejaculatory ducts are torn across and destroyed and sterility follows. This is no doubt sometimes true, but in general the ejaculatory ducts are saved, for they empty into the urethra at the sides of the verumontanum and the rupture of the urethra occurs posterior to that point, but even if the ducts were always destroyed, at the age at which a man seeks relief from his troublesome prostate, the wish to rear a large and happy family does not enter much into his scheme of life.

A small, hard prostate made up chiefly of fibrous tissue can scarcely be enucleated without the aid of vision to direct the enucleation with scissors, and for that reason this class of prostate can only be removed by free exposure and dissection.

### Intraurethral Enucleation of the Prostate through an External Urethrotomy Incision

In this operation the prostate is enucleated from below, precisely in the same way as from above, in the case of a suprapubic prostatectomy.

The typical case for this operation is a prostate moderately enlarged and of medium consistency which is low down in the pelvis, so that on examining it with the finger in the rectum the finger can easily reach the upper margin of the prostate.

On account of the great rapidity with which the operation can be done, requiring only six or eight minutes to perform, it is especially indicated in very old and feeble individuals who are unable to stand the shock of any long operation.

Vesical calculi if they are small in size are no contraindication, as they can be readily extracted through the wound after the prostate is removed.

The healing of the wound is more rapid and the convalescence less prolonged than after the other forms of operation.

**Technic.**—The patient is placed in the lithotomy position and a grooved staff is introduced into the bladder. An external urethrotomy is done and the knife is carried through the posterior urethra, incising the apex of the prostate.

The forefinger is introduced, exploring the prostatic urethra, and noting the amount of bulging of the prostate at the sides of the posterior urethra, the presence of an enlarged middle lobe, and also if the bladder can be easily reached.

To begin the enucleation the mucous membrane at the apex of the prostate is perforated with the finger nail and the finger inserted between the prostate and its capsule, breaking down the fibers which attach it to the gland. The finger is then swept around the lobe, freeing it entirely from all its attachments, and when it is felt to be loosened and lying free within the capsule the lobe is grasped with lithotomy forceps and extracted.

The opposite and posterior lobes should be treated in the same way. During all these manipulations an assistant makes strong counterpressure with the hand over the pubis. This not only

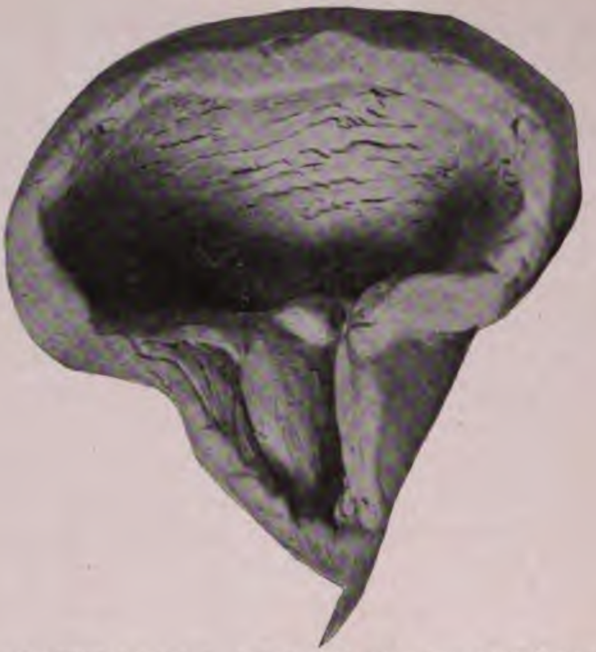

Fig. 205.—Prostatic hypertrophy. Considerable enlargement of both lateral lobes, but especially of the right; high prostatic bar; small nodule on right of the bar; deep bas fond. Favorable for perineal prostatectomy. (Bransford Lewis.)

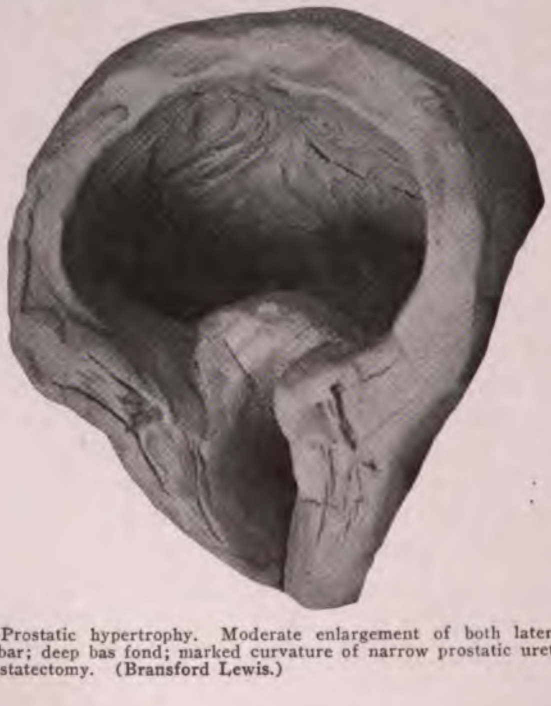

Fig. 206.—Prostatic hypertrophy. Moderate enlargement of both lateral lobes; thick, dense prostatic bar; deep bas fond; marked curvature of narrow prostatic urethra. Favorable for perineal prostatectomy. (Bransford Lewis.)

steadies the prostate, but pushes it down within easy reach of the manipulating finger.

Oftentimes when not very large the entire prostate can be loosened up within the capsule and removed *en masse;* at other times each lobe has to be enucleated separately, and sometimes the prostate has to be removed by a species of *morcellement,* the individual adenomatous tumors being scooped out one at a time, until all of them are removed; this was the original plan of Bryson and practiced by him as a general rule.

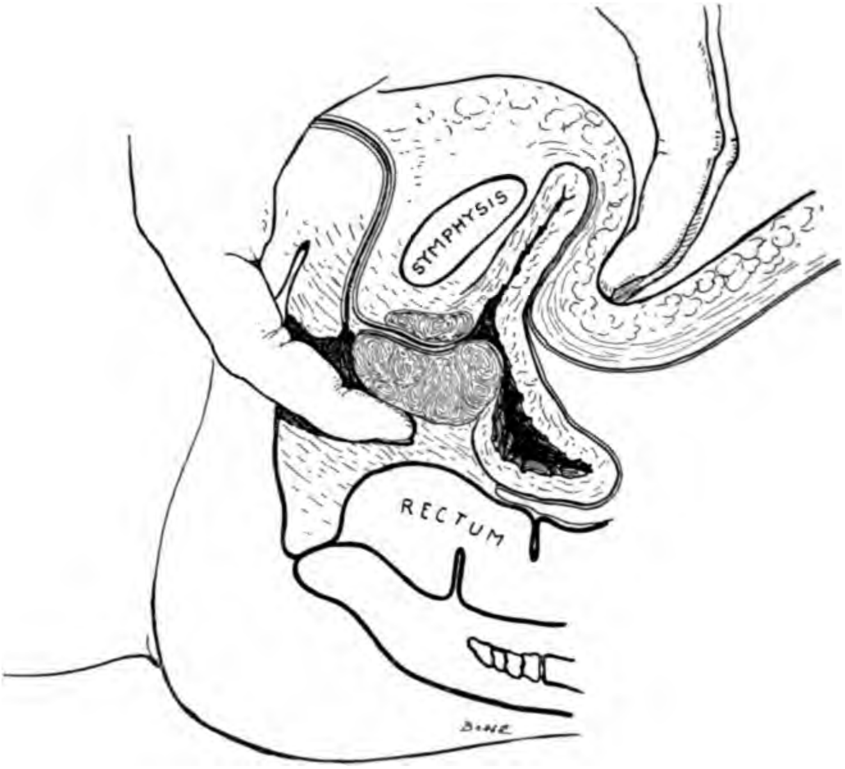

Fig. 207.—Perineal prostatectomy. Intraurethral enucleation with right forefinger. Left hand making counterpressure above pubes.

After the growths have been removed by the process of enucleation, the bladder should be thoroughly explored with the finger for a calculus.

The oozing, which seems to come from the mucous membrane, soon stops after irrigation of the bladder and wound with hot normal salt solution.

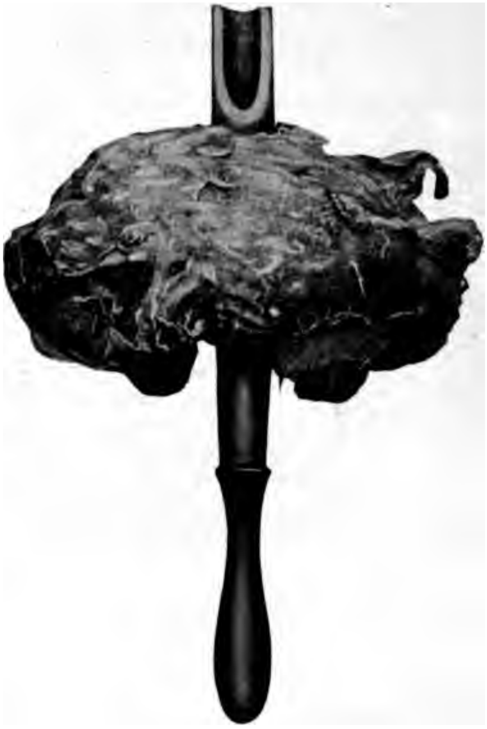

Fig. 208.—Prostate, weight 624 grains, removed by intraurethral finger enucleation *en masse*. (Author's case.)

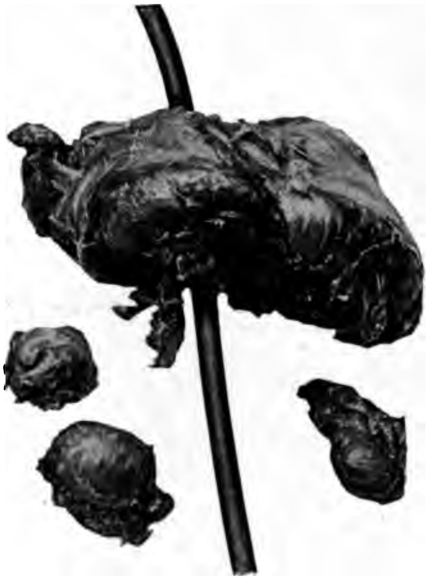

Fig. 209.—Prostate removed by intraurethral enucleation with finger *en masse*. (Author's case.)

A 34 French soft-rubber catheter is then introduced through the wound into the bladder for the purpose of drainage, and gauze is packed firmly around it, and this pressure absolutely controls the hemorrhage.

If the field of operation were now examined with the finger, a large cavity would be made out, lying immediately below the vesical outlet, which formerly contained the prostatic tumors, and is only separated from the rectum by a thin wall.

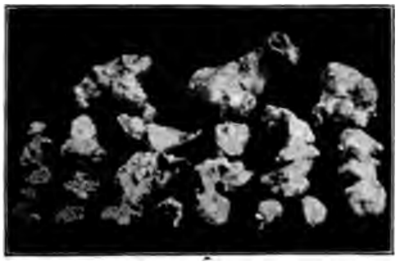

Fig. 210.—Hypertrophied prostate (adenomatous form) after enucleation by perineal prostatectomy. Weight, 1420 grains. (Author's case.)

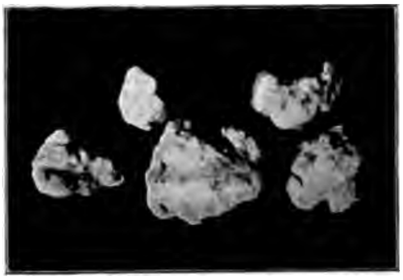

Fig. 211.—Hypertrophied prostate (adenomatous form) after enucleation by perineal prostatectomy. (Author's case.)

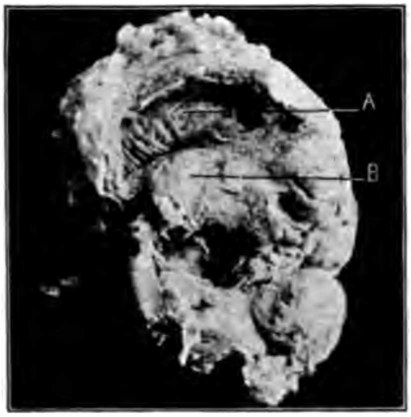

Fig. 212.—Postmortem specimen of bladder after perineal prostatectomy. *A*. Bladder. *B*. Cavity within prostatic capsule formerly occupied by prostate. (Author's case.)

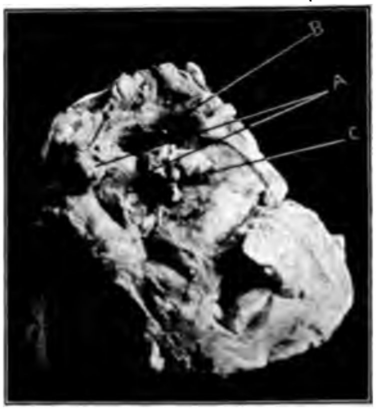

Fig. 213.—Postmortem specimen of bladder after perineal prostatectomy. *A*. Tags of mucous membrane forming sides of posterior urethra. *B*. Bladder. *C*. Cavity within capsule formerly occupied by prostate. (Author's case.)

The floor of the urethra is generally found to be intact, and the mucous membrane forming the sides of the urethra hangs loosely in flaps against the outer sides of the cavity from which the growths have been removed.

These flaps, in the subsequent healing, either slough off and disappear or else become adherent to the walls of the emptied capsule like a skin graft.

In other cases, where the whole prostate has been shelled out of the capsule *en masse*, the entire prostatic urethra has disappeared along with the prostate, and the new urethra is formed by a contraction and cicatrization of the walls of the old prostatic capsule.

It was formerly claimed that very large prostates could not be removed through a perineal incision, but it is surprising to find the facility with which enormous glands can be removed from below, provided an assistant will make firm counterpressure upon the abdominal wall, just above the pubes, with the fingers of the open hand.

In careful hands injury to the rectum is not likely to occur and may be guarded against by putting one finger protected by a finger cot in the rectum as a guide to its proximity. Hemorrhage is never severe and can be controlled by firm packing around the tube.

### SPECIAL POINTS IN AFTER-TREATMENT

The packing of the wound should be loosened in forty-eight hours and a little removed each day; and if a stricture in the anterior urethra was divided, a straight sound should be passed down to the perineal tube. At the end of a week the perineal tube may be taken out permanently and the patient allowed to get out of bed and sit in a chair.

About the tenth day a curved sound, No. 30 French, should be passed into the bladder, and this must be done two or three times a week until the perineal wound heals. If this precaution is not taken the granulating surfaces in the prostatic urethra are apt to adhere together and the urethra becomes permanently occluded.

While in many cases it may not be necessary, still it is certainly safer for a sound to be passed at occasional intervals during the rest of the patient's life.

## Suprapubic Prostatectomy

During the developmental stage of prostatectomy the suprapubic route was the favorite one for approaching the prostate, but as the technic of the dissecting perineal operations was perfected by Continental surgeons, especially Proust and Albarran in France and

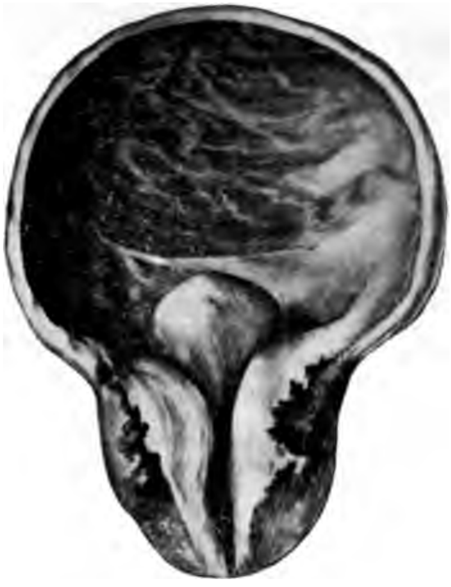

Fig. 214.—Prostatic hypertrophy. Bilateral enlargement, but no obstruction from that source; intravesical globular tumor, pedunculated, which obstructs in ball-and-socket-valve manner. Bottini inappropriate; suprapubic removal the operation of choice. (Bransford Lewis.)

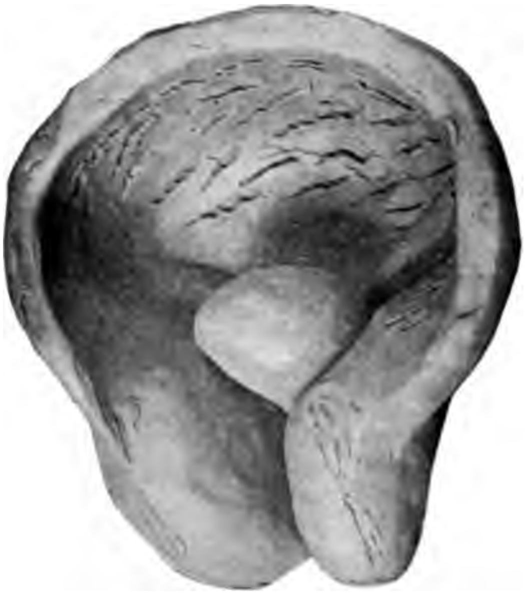

Fig. 215. Prostatic hypertrophy. Marked enlargement of both lateral lobes, and globular intravesicular tumor from posterior commissure. Removal of tumor and both lobes required; best accomplished through suprapubic route. Bottini inappropriate and inadequate. (Bransford Lewis.)

Hugh Young in America, the fashion in practice for a time became to remove all prostates through the perineum.

The admirable work done by Eugene Fuller, of New York, and Freyer, of London, however, caused the pendulum to swing again, and today in France and Germany the perineal operation has largely lost its vogue and the suprapubic route is the one generally adopted.

The typical cases for suprapubic prostatectomy are the enormous prostates or those enlargements of considerable size which extend high up in the pelvis and where the lobes project up into the bladder.

While some of these can be removed through the perineum, the upper portions of many of them are out of reach of the enucleating finger from below, and the logical route of attack must be from above, as was first pointed out by Watson in 1888.

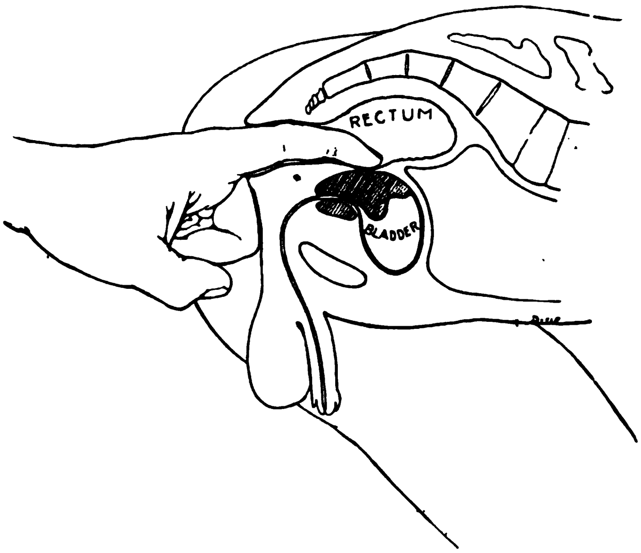

Fig. 216.—Senile hypertrophy of prostate. Finger in rectum can not reach upper margin of prostate. Suprapubic prostatectomy operation of choice.

These cases may usually be recognized by rectal examination, for the examining finger can not touch the upper margin of the prostate, but falls short of reaching the upper border.

A cystoscopic examination shows a large intravesical growth projecting upward in the bladder or perhaps only an isolated middle lobe standing upright like a ball valve.

The presence of large vesical calculi may also be considered a sufficient reason for adopting the high operation.

The mortality rate is very slightly higher than in the perineal operation, the amount of postoperative shock is greater, the convalescence and time of wound healing are more prolonged, and the patient is constantly bathed in his urine until urethral urination is reestablished. As an offset to these objections, there is much less liability to subsequent incontinence of urine.

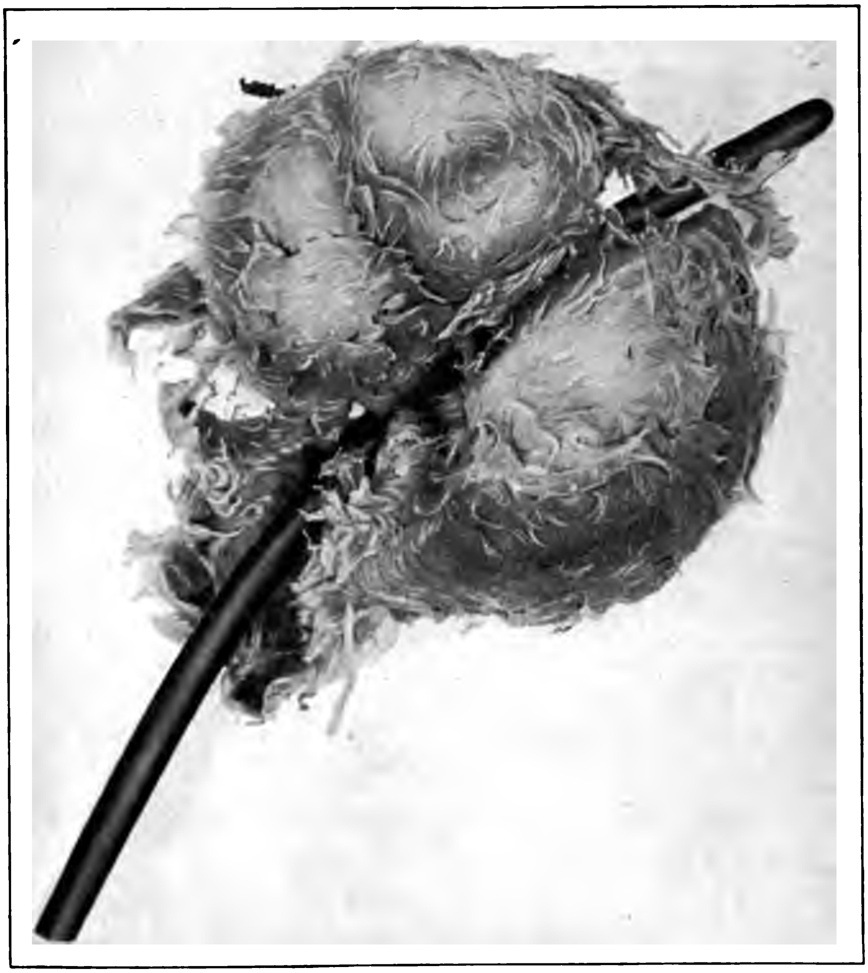

Fig. 217.—Prostate weighing 6¾ ounces causing complete retention for five years. Typical case for suprapubic prostatectomy, by which it was removed. (Author's case.)

Patients with fat bellies are not so well suited to this form of operation on account of the liability to subsequent necrosis and sloughing of the abdominal wound, with consequent sepsis.

The technic of suprapubic prostatectomy as done by Freyer differs in some minor points from Fuller's mode of operating, for the former surgeon endeavors to enucleate the prostate in one mass from its enclosing capsule.

The posterior urethra is torn across at the point of location of the verumontanum and removed with the prostate. The ejaculatory ducts are sometimes destroyed, but in the majority of cases the ducts remain uninjured in the portion of urethra which is left behind.

**Technic.**—The bladder is filled with water and the catheter left in the urethra.

With the patient in the Trendelenburg position the bladder is opened by a suprapubic incision and the forefinger of the left hand protected by a finger cot introduced into the rectum to push the prostate up toward the bladder and hold it steady during the manipulations. The mucous membrane over the most prominent portion of one lateral lobe is scraped through by the finger nail and the true capsule of the prostate which lies within the enveloping sheath is at once reached.

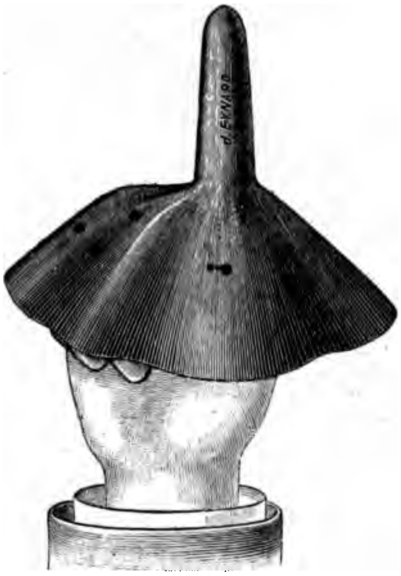

Fig. 218.—Rubber finger cot and shield for hand for use in prostatectomy.

Bentley Squier *inserts his finger into the anterior commissure of the prostatic urethra* and breaks through the mucous membrane at that point, claiming an easier access to the lines of cleavage by this approach.

The enucleation of the prostate and of its enveloping sheath is performed by insinuating the finger tip, in succession, behind, outside, and in front of one lateral lobe, thus separating the capsule from the sheath. The finger is thus swept in a circular fashion from without inward, in front of and to the inner side of the lobe, detaching this from the urethra, which is felt covering the catheter introduced before opening the bladder, and pushed forward toward the symphysis between the lateral lobes, which will, as a rule, have separated along their anterior commissure in the course of the manipulation. The other lobe is attached and treated in the same manner. The finger is next pushed well downward behind the prostate on the anterior surface of the gland and is peeled off the triangular ligament.

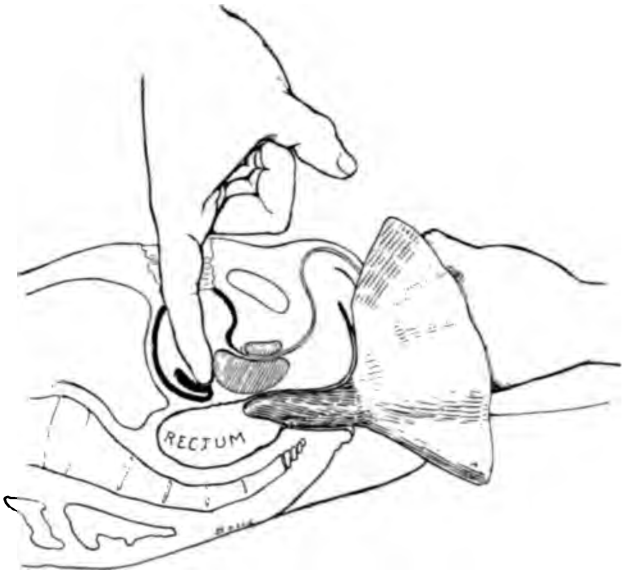

Fig. 219.—Suprapubic prostatectomy, right forefinger enucleating prostate and left finger in rectum making counterpressure.

When the prostate is felt free within its sheath and separated from the urethra with the finger in the rectum aided by that in the bladder, it is pushed out of the bladder through the opening in the mucous membrane, which during the manipulation will have become considerably enlarged.

The prostate, which now lies free in the bladder, is withdrawn by strong forceps through the suprapubic wound.

is but very little bleeding, and that is arrested by pressin

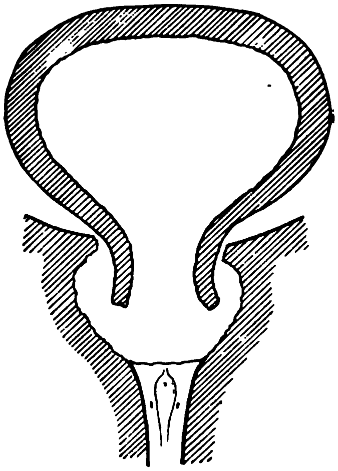

Fig. 220.—Flap of bladder, mucous membrane applying itself to sides of cavity, from which prostate has been enucleated either by perineal or suprapubic finger enucleation.

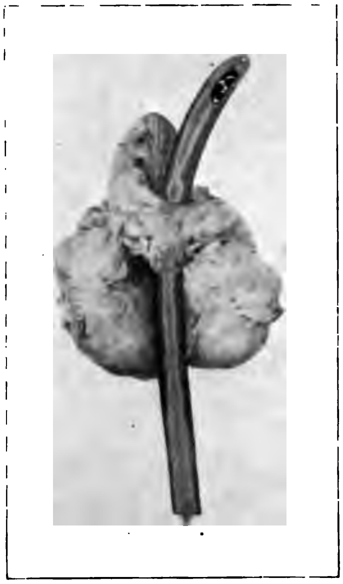

Fig. 221.—Prostate removed by suprapubic route, showing projection of middle lobe. (Author's case, Long Island College Hospital.)

the walls of the cavity, formerly occupied by the prostate, together by the points of the fingers in the rectum and bladder, and the use of hot irrigations.

While the bleeding generally stops with these manipulations, many genitourinary surgeons feel that it is safer to take precautions to control any oozing or subsequent hemorrhage. There are three methods in use today:

1. Sewing the capsule of the prostate with a running suture to include any bleeding vessels in the torn edge of the mucous membrane. (Cabot and Judd.)

2. Introduction of a rubber bag, which is blown up with air into the cavity of the enucleated prostate. (Francis R. Hagner.)

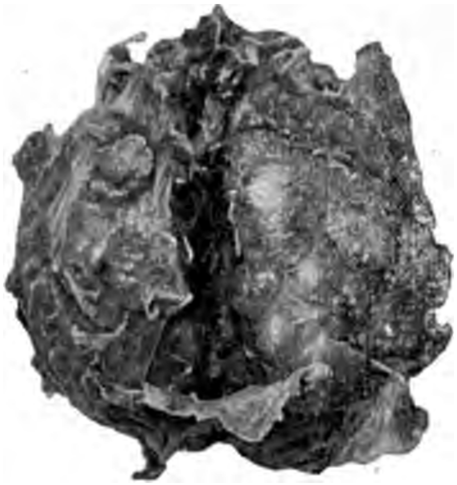

Fig. 222.—Prostate removed by suprapubic prostatectomy. (Author's case.)

3. Packing the cavity of the enucleated prostate with gauze after free exposure of base of bladder and trigone by introducing angled retractors into the bladder. (Morton.)

The bladder having been cleared of clots, a stout India-rubber drainage tube is introduced through the suprapubic wound. Freyer regards the dimensions and management of this tube as of the utmost importance in the after-treatment of prostatectomy. The tube is 4 inches long, 1 inch in diameter, with a lumen of ⅞ inch, and is provided with two large perforations, or eyes, at its end.

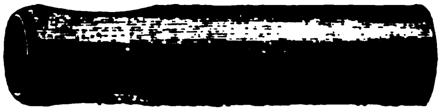

Fig. 223.—Freyer's suprapubic tube for bladder drainage after prostatectomy.

About one inch of the tube should project into the bladder, just enough for the side openings to lie completely within its cavity, but the tube must not enter the cavity of the prostate.

The incision in the bladder wall is then sutured, with two layers of catgut around the tube, thus permitting all the urine to escape through it, and infection and cellulitis of the loose tissues of the prevesical space are prevented.

The muscles and fascia are then sutured with catgut, the space of Retzius filled with a gauze tampon and the abdominal wall closed with silkworm-gut around the tube. A suture is passed through the abdominal wall and drainage tube to keep it in position. The wound is covered with gauze and the patient's body swathed in absorbent dressings, which must be changed every four to six hours, when saturated with urine. The tube should be removed four or five days after the operation.

Attempts have been made in the Necker Hospital and elsewhere to drain the bladder by a permanent catheter in the urethra, but have always resulted badly, for patients develop urinary fever and abscesses. Freyer explicitly states that the cavity within the prostatic capsule must be left empty so that it may close down and heal, and anything inserted through it or into it will prevent this aim.

## Accidents During Operation

Opening the peritoneal cavity occasionally happens, particularly when the bladder is not sufficiently distended, for in old men the peritoneal fold is often relaxed and hangs lower than in young individuals. It is not a serious accident if the incision is repaired at once with fine silk.

The method of controlling hemorrhage has already been described, but in exceptional cases the bleeding may be so severe that the entire cavity of the bladder as well as that formerly occupied by the enucleated prostate, must be firmly packed with gauze which is left in forty-eight hours. This does not obstruct the outflow of urine, which seeps out freely through the gauze. Of course when the entire bladder is packed with gauze the drainage can not be employed; but where only the cavity of the prostate has been packed, the end of the gauze may be brought out alongside or through the lumen of the tube.

Firm adhesions of the prostate to its capsule may require the insertion of retractors into the bladder, free exposure of its cavity, and their division with scissors; occasionally the urethra must be treated in the same way, and cut across when it does not tear readily.

Injury to the rectum must be guarded against constantly, by keeping one finger in the rectum during the process of enucleation; by knowing constantly the position of the enucleating finger and the degree of force exerted by it, laceration of the thin prostatic capsule into the rectum can be avoided.

## Special Points in After-treatment

During the first twenty-four hours the patient should lie on his back; after this time he should be turned from side to side every two hours to prevent hypostatic pneumonia, but should not be allowed to move himself for fear of causing hemorrhage.

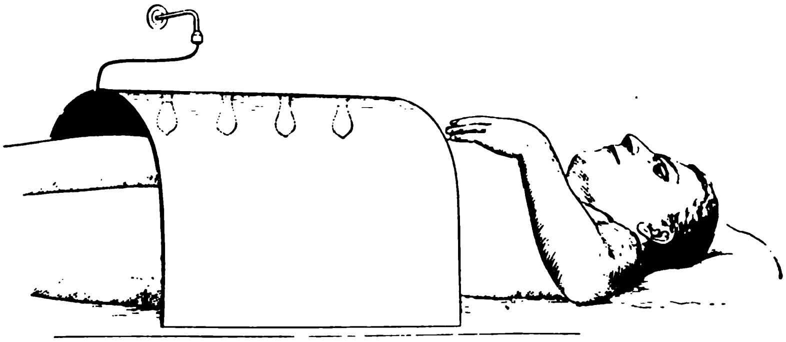

Fig. 224.—Electric baker for treatment of postoperative shock.

The pack in the prostatic cavity may be loosened in from 48 to 72 hours and entirely on the fourth or fifth days.

After the large Freyer tube is renewed on the fifth day, a smaller tube may be inserted into the bladder with advantage in an occasional case, and the wound in the abdominal wall packed around the tube with gauze soaked in 2 per cent liquor aluminii acetatis. In this way urine is kept from contact with the surface of the wound during its healing, and one great danger and occasional cause of death, viz., gangrene of the wound and general sepsis, is greatly minimized.

As a general rule the author does not employ a smaller tube, after the removal of the Freyer tube, but depends on frequent changing of the absorbent gauze dressings to collect the urine and keep the patient dry and comfortable.

After a couple of weeks when the wound is granulating well and has become small, an India-rubber apron is made use of to collect the urine and allow the patient to sit up in a chair without getting wet.

The apron is made by taking a piece of rubber dam such as dentists use. A hole is cut in the middle and the apron made to adhere to the abdominal wall by smearing it with zinc ointment. Pads of gauze are placed over the opening, which collect the urine as it flows through the wound. The free edges of the apron are then folded over so as to enclose the gauze. This makes a water-tight receptacle, to contain the gauze, which is renewed every few hours.

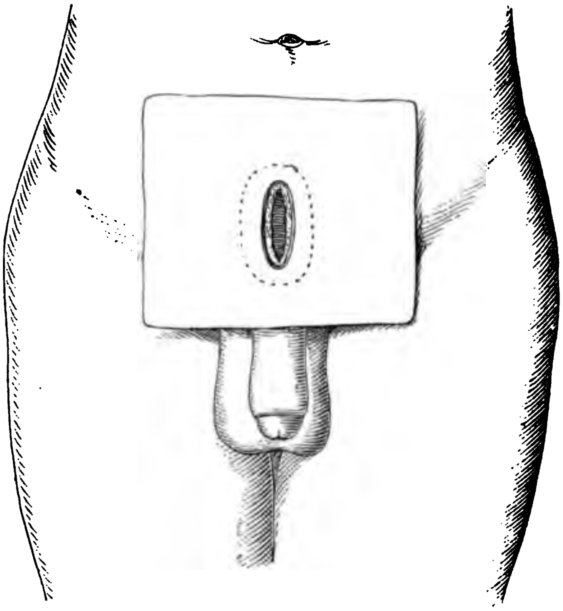

Fig. 225.—Rubber dam apron for suprapubic drainage, open.

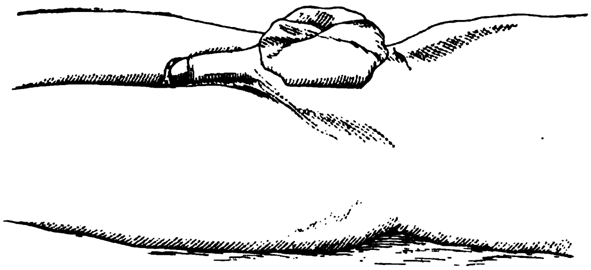

Fig. 226.—Rubber dam apron for suprapubic drainage closed and enveloping folded gauze over wound.

The wound should be entirely healed in from four to six weeks, but urethral urination begins long before this time.

## Prostatectomy by Means of a Transverse Incision in the Perineum and Enucleation of the Prostate under Guidance of the Eye

This so-called dissecting operation was developed originally in France by the work of Proust and Albarran, and improved by Hugh Young, of America, and for several years was the operation of choice on the continent of Europe.

### Technic

The first step in the operation consists in placing a 24 French Guyon sound in the urethra to be used as a guide, as its introduction is difficult after the thighs have been flexed.

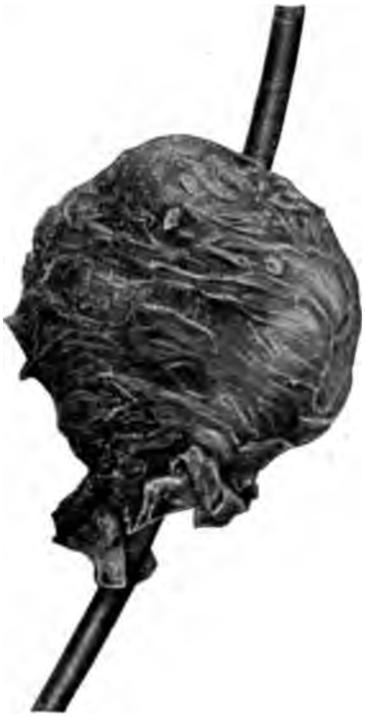

Fig. 227. Prostate removed by suprapubic prostatectomy. Weight 1 ounce. Could also have been removed by intraurethral finger enucleation. (Author's case.)

### Position of the Patient

The patient is placed in the exaggerated lithotomy position, lying on an inclined plane, with the thighs flexed upon the body and moderately separated, supported by special leg supporters attached to the table. The perineum should be so elevated that it is almost parallel with the floor.

*Landmarks for the Skin Incision.*—(*a*) ***The Bulb of the Corpus Spongiosum.***—Its prominence can usually be seen under the skin, but by drawing the thumb backward in the median line its termination can be distinctly felt.

(*b*) *The Two Tuberosities of the Ischium.*—The perineal planes are divided layer by layer, and the three steps necessary may be considered as follows:

### Section of the Perineal Planes

(*a*) Section of skin, fat, and superficial fascia.

(*b*) Section of the perineal central tendon and exposure of the margins of the levator ani.

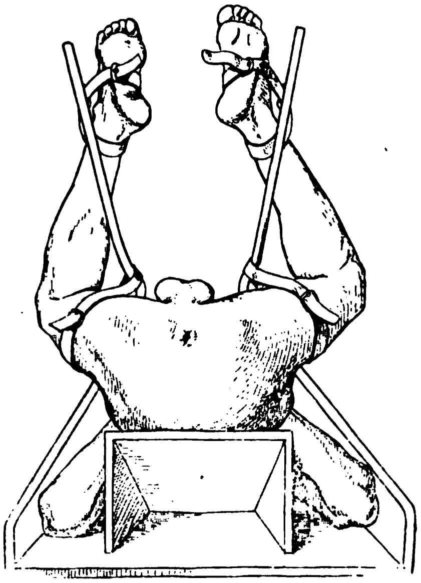

Fig. 228.—Exaggerated lithotomy position for Albarran-Young's prostatectomy.

(*c*) Opening of the space "decollable interrecto prostatique."

(*a*) *Section of Skin, Fat, and Superficial Fascia.*—An incision is made from one tuberosity to the other, curving slightly and passing two fingerbreadths in front of the anus.

The subcutaneous fat is incised. It is sometimes thick and sometimes scanty. At the extremities of the incision, one finds the ischiorectal fossa; here the incision is made deeply and freely. In the median segment it is made superficially and cautiously.

(*b*) *Section of the Perineal Central Tendon and Exposure of* ***Mar-***

*gins of Levator Ani Muscle.*—Dissection with the scalpel, held transversely, soon exposes the perineal tendon,[1] which is divided transversely close to the bulb. Firm retraction on the anus facilitates the exposure of the tendon.

The bifid retractor of Young is an excellent instrument, aids greatly in the exposure of the tendon, and greatly facilitates its division. This retractor is removed after the tendon has been cut.

After severing the central tendon the proper inclination to give the knife is of fundamental importance. It should be directed toward the umbilicus of the patient with a slight inclination; if held vertically it menaces the rectum; if horizontally, it may wound the bulb or the urethra.

After the central tendon has been divided in the median line, the bistoury divides some fibrous tissue of a thickness of some millimeters. Suddenly the median region gapes widely open. At this stage, an anterior retractor may be placed beneath the bulb and a posterior retractor, about two inches in depth, is inserted, by which the rectum can be pushed back. Traction upon these retractors enlarges the wound and puts the rectourethralis muscle, which appears in the depth of the wound as a small muscle band running anteroposteriorly, upon the stretch.

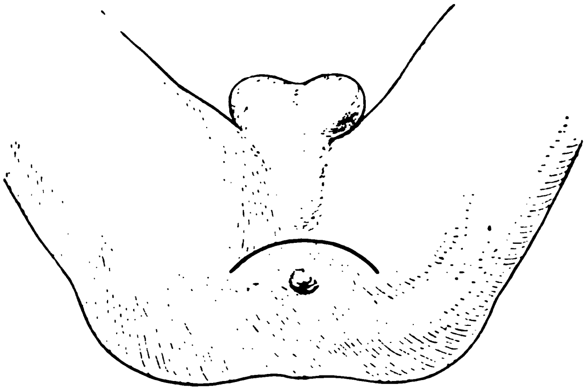

Fig. 229.—Line of incision for the Albarran-Young prostatectomy between the anus and the bulb, terminated laterally by the ischii.

The rectourethralis is a short muscle with rather indefinite margins, which, as its name indicates, joins the rectum with the urethra.

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[1] The central tendon of the perineum is a fibrous point in the middle line of the perineum between the urethra and rectum, being about one-half inch in front of the anus. At this point four muscles converge and are attached; viz., external sphincter ani, bulbocavernosus, and the two transverse perinei, so that by the contraction of these muscles, which extend in opposite directions, it serves as a fixed support.

It is apparently responsible for the acute anterior flexure of the rectum which lies so close to the apex of the prostate and membranous urethra and which one finds in rectal examinations. In order to reach the membranous urethra and the apex of the prostate, it is necessary to divide this muscle.

A failure to cut these muscular fibers is responsible for the tears into the rectum which occur so frequently in this operation, for if downward pressure is made upon it with the finger or a retractor, the muscle does not yield, but its insertion into the wall of the rectum tears out and a laceration of the thin wall is caused.

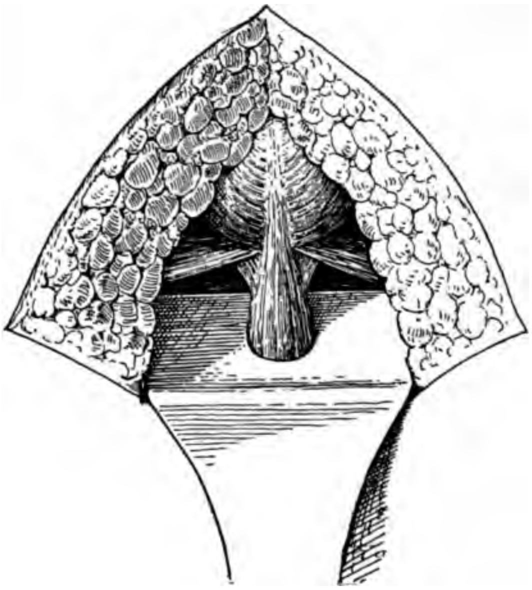

Fig. 230.—Exposure of bulb, central tendon, and levatores ani. Bifid retractor making tension on central tendon.

To divide the rectourethralis muscle, it is grasped near its rectal insertion with anatomic forceps, making slight traction, and, with the bistoury held almost horizontally, is cut in its anterior part. Puncture of the urethra may be avoided by using the sound, previously introduced, as a landmark.

(*c*) *Opening of the Space "Decollable Interrecto Prostatique."*—As soon as the rectourethralis muscle is cut, a large cavity between the rectum and the prostate gapes widely. It is the space "decollable interrecto prostatique." With the finger it is enlarged. Then the two fingers are introduced side by side and widely separated, thus widely opening up the space.

The aspect of the operative region is then the following: Behind are seen the anus and the external sphincter, from which the edges of the levator ani run in a forward direction, to be lost in the depths of the wound; in front the bulb attached laterally by the transverse superficial muscles. In the center a vast cavity, its posterior wall formed by the rectum, which appears smooth and shining, as if covered with serous membrane.

The anterior wall is formed by the prostate, also covered by a smooth shining membrane. At the bottom, if the dissection is carried to the extreme limit, the peritoneum of the *cul-de-sac* of Douglas.

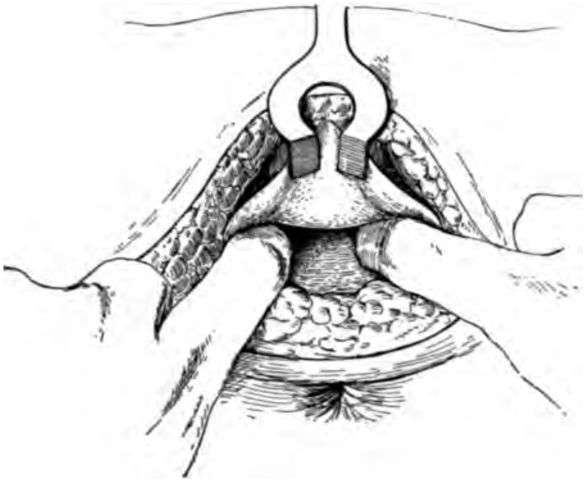

Fig. 231.—Enlarging with the fingers the space decollable inter-recto prostatique.

The penetration into the space "decollable interrecto prostatique" is the important point in exposing the prostate. The key to this space is the little rectourethral muscle, and as soon as this is divided the space is opened. If great care is not exercised, in the division of this muscle, to keep close to the membranous urethra but without opening it, the dissection will be made below the posterior layer of the aponeurosis of Denonvillier (obliterated peritoneal sac), between it and the rectum, instead of between the two layers of this structure, where is found the space "decollable interrecto prostatique." The demonstration that the dissection has been properly made is the smooth, shining appearance, like serous membrane, of the rectum.

### Extirpation of the Prostate

*Steps*:

(*a*) Opening of the urethra and retraction of gland.

(*b*) Dissection of the capsule.

(*c*) Hemisection and extirpation of the lateral prostatic lobes.

(*d*) Extirpation of the median lobe.

(*e*) Perineal drainage and closure of wound.

(*a*) *Opening of the Urethra and Retraction of the Prostate.*—After the membranous urethra has been exposed, by the incision of the rectourethral muscle, it is opened on the previously introduced sound, and the edges of the urethral wound caught up by silk guide sutures or Halsted forceps. The urethral sound is removed and the prostatic tractor (preferably Young's) introduced, closed through the urethral wound into the bladder. As soon as the beak is free in the vesical cavity the thumbscrew, which fixes the blade in position, is loosened, blades rotated 180 degrees, and fixed by tightening the thumbscrew.

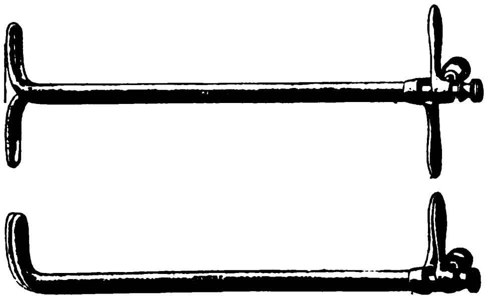

Fig. 232.—Young's prostatic retractor.

Albarran's or Young's posterior retractor is introduced into the space "decollable interrecto prostatique." Traction upon the retractor placed within the bladder makes the gland emerge between the levator ani muscles, giving a splendid exposure of the entire posterior surface of the prostate.

(*b*) *Dissection of the Periprostatic Capsule.*—Albarran incises the capsule of the prostate in the median line from the membranous prostatic junction to the apex of the prostate.

Young makes two incisions, on either side of the median line, 15 cm. deep, with the object of preserving the ejaculatory ducts; then by dissection, with a dissector or the closed points of blunt curved scissors, the capsule is gently stripped off the gland.

This separation should be carefully made on the lateral surfaces, which are vascular regions, and carried as far forward as possible, just in front of the urethra, nearly in the median line.

It is sometimes necessary for the lateral freeing of the capsule to seize each half with toothed forceps and make traction away from the gland.

(*c*) *Hemisection and Extirpation of the Prostate.*—The prostate is incised along its entire length, in the median line. This incision divides the prostate into two lateral halves. It is carried down to but not into the urethra.

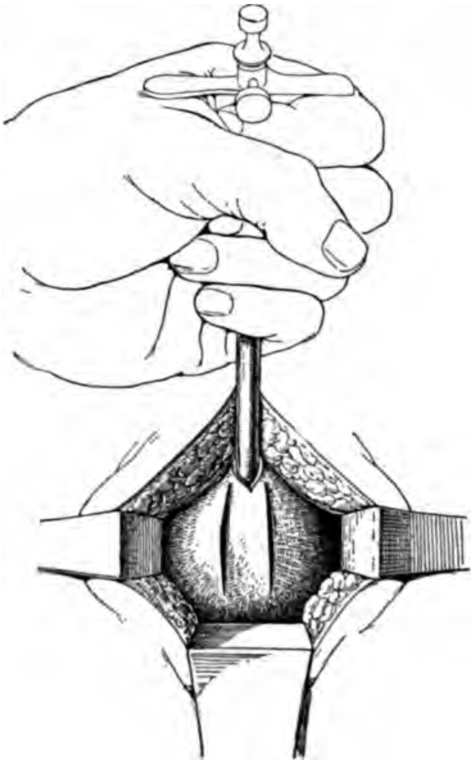

Fig. 233.—Young's retractor introduced, blades separated, traction made exposing posterior surface of prostate incision in capsule on each side of ejaculatory ducts.

Young hemisects the prostate by two incisions down to the urethra, leaving a bridge of prostatic tissue, containing the ejaculatory ducts, and the extirpation of the prostatic lobe is commenced from within outward, and terminates from without inward. The urethra is dissected, along its entire length, from the prostatic lobe, with scissors. The separation is made comparatively easy by a sort of plane of cleavage,—interuretero prostatique.

Often the finger answers the purpose better, and it is usually easy to find the lines of cleavage unless the prostate is very hard and fibrous.

After the urethra has been liberated from the lobe, the lobe is drawn toward the opposite side; its external surface is freed so far as possible; then the finger, sweeping around the lobe, from without inward, liberates it entirely and pushes it backward.

The superior surface is disengaged with great facility from the bladder. The freed lobe now rests hanging from the genital pedicle—vasa deferentia and vesiculæ seminales.

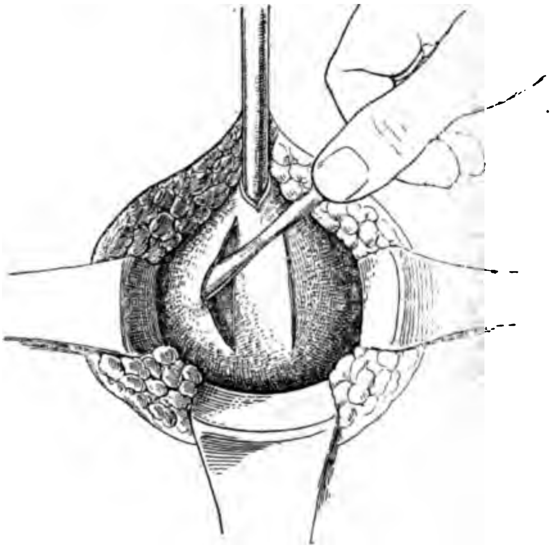

Fig. 234.—Beginning the enucleation by separating the capsule from the prostate.

Albarran does a double vasectomy in the scrotum to prevent epididymitis.

(*d*) *Median Lobe.*—After the lateral lobes have been removed, the prostatic tractor is removed. The finger is inserted through the urethral wound into the bladder. Pressure upon the median lobe everts it, and it is removed with curved scissors.

(*e*) *Perineal Drainage and Closure of Wound.*—Following the enucleation of the median lobe, a perineal drainage tube 32° F. is passed through the urethral wound into the bladder. After being properly adjusted it is sewn to the upper angle of the wound with a single ligature.

A large-caliber drainage tube should always be provided, as a small tube may easily become plugged by blood clots, and may necessitate removal of the tube before they can be removed, whereas when the same conditions occur in a tube of large caliber they can generally be removed with the aid of a Janet-Frank bladder syringe without removal of the tube.

A strip of gauze is packed snugly into the prostatic cavity and the free end of the strip is brought down through the outer wound, which it should not fit tightly, for too much pressure against the rectal wall may produce sloughing and lead to a fistula.

Before closure of the wound, the rectum should always be examined for lacerations, which if found, should be repaired with a double row of "intestinal" sutures.

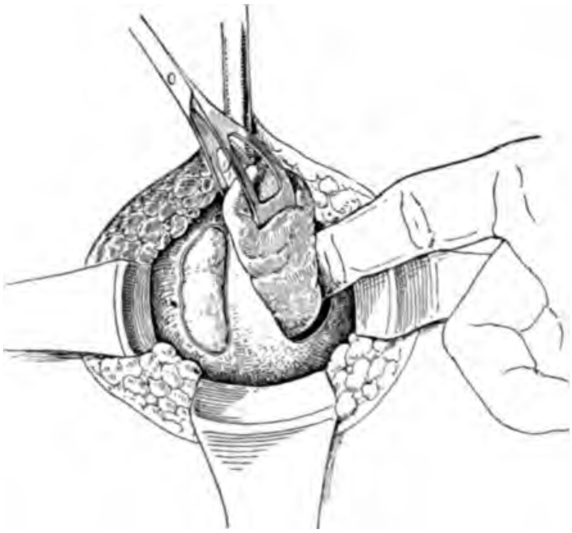

Fig. 235.—Enucleation of lateral lobes with finger while grasped with forceps.

The levator ani muscles should be approximated with a single heavy catgut suture. This procedure is of great value (Young).

The extremities of the skin wound are partially closed with sutures, leaving a small area in front for the tube and gauze drains.

## Special Points in After-treatment

The gauze drain is removed within twenty-four to thirty-six hours after the operation, and is not usually reapplied.

The length of time for which the tube drains the bladder varies with different operators: Young removes it in twenty-fo
other operators, in about a week.

The patient should be placed in a chair during intervals of the day, as soon as tubes have been removed.

Urotropin is administered early, and water is given in abundance.

The bladder is irrigated through the perineal tube twice daily with sol. oxycyanide of mercury, 1:4000.

In this operation the use of sounds is not necessary subsequently.

## Comparison Between Other Methods of Prostatectomy

From the foregoing description it is evident that the technic of this operation is complicated and difficult and requires a number of rehearsals upon the cadaver before it can be attempted upon an old man.

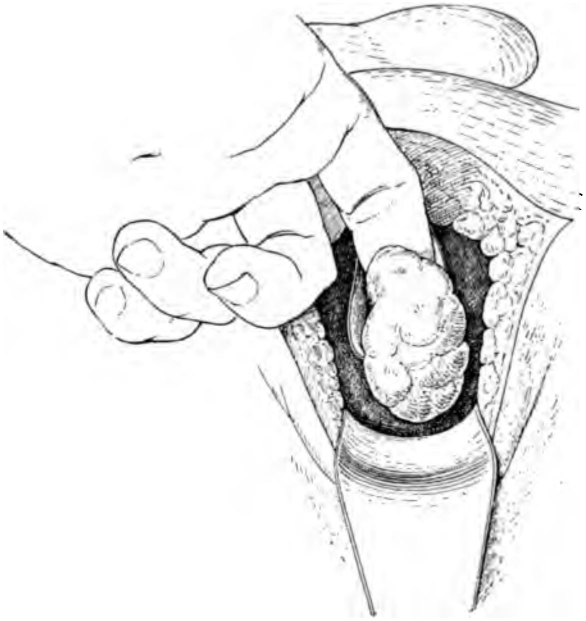

Fig. 236.—Enucleation of middle lobe by hooking finger over it and forcing it down into perineal wound.

Although the brilliant technic of Hugh Young enables him to complete the operation in fifteen minutes, with most surgeons it requires a far longer time to perform than either of the forms of finger enucleation.

In addition to the length of time required, there is always the danger of wounding the rectum.

If vesical calculi are present they may be overlooked more easily than with the suprapubic route, and sometimes a middle lobe offers culties in the way of its removal, especially the pedunculated ball-lve form.

Although the patient can get out of bed within a few days after eration, the convalescence is slow, on account of the large wound in e perineum, which requires a long time to granulate.

For these reasons the operation is no longer as popular as it was e years ago, even in France where it originated, the suprapubic peration having very largely superseded it.

The only advantage which can be claimed for it to counterbalance e difficult technic, length of time required to perform, and liability f wounding the rectum is the possible greater chance of preserving he ejaculatory ducts. As previously stated, these are frequently not estroyed by the other enucleations, and, even if they were, it is but a matter of little moment at that time of life.

The operation, however, has unquestionably one field of usefulness and that is in the small, hard, fibrous prostates which are so adherent to the capsule that they can hardly be enucleated by the finger. This form of prostate can readily be removed by free exposure of the gland and cutting it away from its adherent capsule by scissors and blunt dissection.

## Choice of Operation in Hypertrophied Prostate

The perfection of the operative technic, as well as the improvement in the preliminary treatment and after-treatment of prostatectomy, has placed the surgeon in a position where he can conscientiously advise an old man with hypertrophied prostate and residual urine to take the slight risk of death from the operation, rather than go on to the uncomfortable and dangerous state which a catheter life entails with the strong probability that a prostatectomy will have to be done eventually when the patient is no longer in very good condition to stand a serious operation.

There are certain conditions which differ in each individual, and which have to be carefully considered before selecting the operation which seems most applicable to the case in hand.

To the author it seems that the choice between suprapubic and perineal prostatectomy must be decided largely on the local conditions.

If rectal examination shows the upper border of the prostate to be high up and out of reach of the examining finger, and the cystoscope demonstrates a considerable amount of intravesical projection of the prostate, the logical and easy approach is by the suprapubic route. It would be difficult to take such a prostate out through the perineum on account of the size and the increase in the perineal distance.

On the other hand with a prostate which is not very much enlarged, we are able, on introducing our finger into the rectum, to feel the prostate low down, and the best way to approach such a prostate is by the perineal route. To my mind, we make our decision actually on the anatomic conformation of the prostate. We know before operating which is the better route to choose.

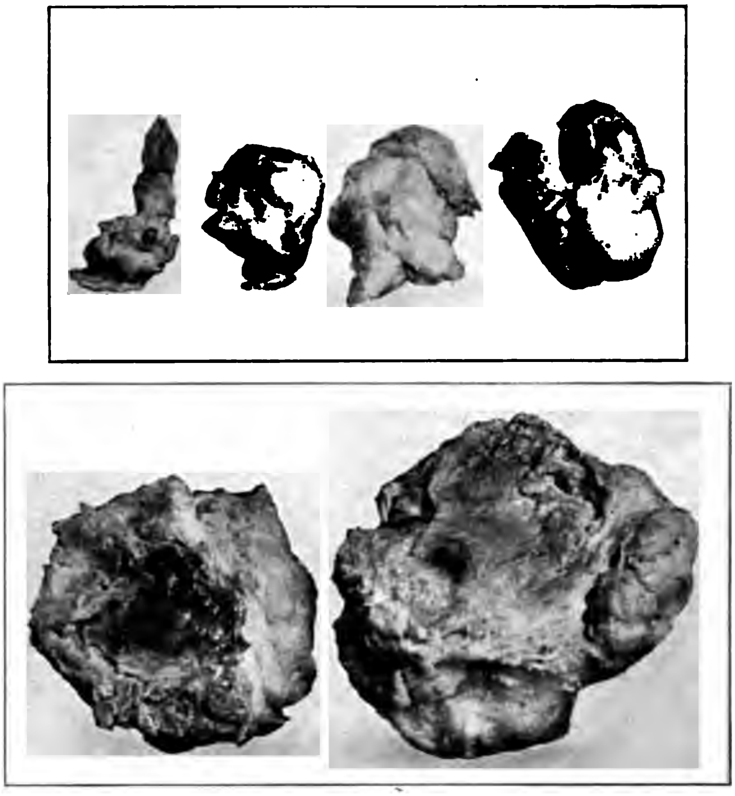

Fig. 237.—Prostate removed by perineal operation with Young's technic. (Author's case.)

The question of the anesthetic is important. It is essential not to drown old men with ether. It must of necessity be eliminated and passed out through the kidneys: they are more or less crippled, and the shock and additional weight of unnecessary ether thrown on them are liable to cause the kidneys to shut down. The ideal anesthetic for old men is gas-oxygen with a little ether. Ether, if carefully given in small quantities, can also be used safely as an anesthetic. I have done some cases under spinal anesthesia with stovaine, which, as a general thing, acts pretty well, although, personally, I prefer a general anesthetic.

## Points for Consideration

**I. General Conditions.**—(*a*) The age of the patient.

(*b*) The state of his general health.

(*c*) The condition of his sexual powers.

(*d*) The state of his kidneys.

(*e*) The amount of atheroma in the arteries.

**II. Condition of the Prostate and Bladder.**—(*a*) The size and density of the prostate.

(*b*) The form of the obstruction: whether it is in the form of a bar across the vesical outlet, a tumor deflecting the urethra, or a mass the size of an orange filling up the pelvis.

(*c*) The condition of the bladder in relation to its atony or hypertrophy.

(*d*) The quantity of residual urine.

(*e*) Catheterization, its ease, or if attended with pain and bleeding, and its necessary frequency.

(*f*) The severity of the accompanying cystitis.

**III. Complicating Conditions.**—(*a*) Vesical calculus.

(*b*) Stricture.

(*c*) Diabetes.

For the better selection of an operation it is useful to adopt the classification of prostatic cases suggested by J. William White.

**Class A.**—Patients with moderate enlargement of the prostate, who suffer little or no pain, and with clear residual urine to the extent of three or four ounces. Such cases can be subjected to prostatectomy with the minimum risk to life. The patients, however, are seldom willing to submit to early operation, with a view of preventing a worse state, but prefer to temporize until, thus, difficulties increase and they come into Class B.

**Class B.**—These patients suffer with marked obstruction from the prostatic overgrowth at the vesical outlet. The prostate ranges in size from one and one-half inches in diameter to three inches (about the size of a lemon). The residual urine may be eight or ten ounces in amount, or there may be complete retention. The cystitis is marked, and the urine is purulent, ammoniacal, and fetid, and operative interference of some kind is clearly indicated.

If the patient is strong and vigorous, with active sexual pow free from atheroma, with sound kidneys, and if the hypertrophy is glandular in character, causing the prostate to be soft and elastic and of large size, prostatectomy in most cases is followed by complete restitution of the bladder function.

The conformation and relation of the prostate to the bladder will determine whether it is to be approached by the perineal or suprapubic route.

**Class C.**—In this class the patient is old and very feeble, with marked atheroma and diseased kidneys. The prostate may range from two inches in diameter to the size of a small orange. Retention of urine is nearly or quite complete, and catheterization is difficult and painful.

Prostatectomy, while more dangerous than in Class B, may still be undertaken with hopes of success, and it is astonishing to see how well such an individual will stand a rapid prostatectomy, provided he has had adequate preliminary treatment and the phthalein test shows his kidneys able to support life after operation.

**Class D** includes the desperate cases with enormous prostates and excessive cystitis. The bladder is dilated and saccular, the retention complete, and catheterism difficult. These patients are advanced in years, and suffer from chronic urinary fever. The kidneys are diseased, and atheroma is extreme. Any surgical operation is attended with great danger, but the patient's suffering is so great that he is willing to accept any risk for the sake of relief.

In these cases the only operation which could be endured would be the establishment of permanent drainage of the bladder through a suprapubic fistula under local anesthesia, and after some weeks or months a prostatectomy through the existing fistula might be undertaken with some chance of success.

**Diabetes** is regarded as debarring all operations unless catheterization is impossible. In such cases permanent drainage through a suprapubic fistula affords the best means of relief.

**Results of Suprapubic and Perineal Prostatectomy.**—At the time that the operation of complete removal of the prostate first came into prominence the objection was raised by Guyon, Socin, and Thompson, on theoretic grounds, that, even though the obstructing prostate be removed, the contractile power of the bladder has been so much impaired that the patient will be incapable of spontaneous urination after the operation. The tabulated results of hundreds of prostatectomies, however, now demonstrate that in 90 per cent of the cases restoration of the bladder function does take place, and that patients who were previously dependent upon the catheter are enabled to urinate voluntarily again.

No operation in surgery shows more gratifying results than a successful prostatectomy. After the operation and recovery the patient has unbroken sleep; he can take up his social and business obligations without being forced to interrupt the proceedings every little while to pass the catheter, and he gains weight, strength, and mental cheerfulness.

The train of conditions of residual urine, back pressure, ascending infection, and pyelonephritis, which in the end lead inevitably to a fatal issue, are removed, and the patient's longevity expectation is placed upon a normal level.

With the desperate cases who were suffering from chronic urinary fever, from absorption, and who for months have been afflicted with broken rest, dyspepsia, fever, and emaciation, prostatectomy is veritably a life-saving operation, and the change to normal conditions again is most striking.

In order to avoid the danger to life of back pressure and ascending infection and to insure complete restitution of the bladder function, as has been previously pointed out, early operation is demanded, and the patient should not be allowed by the family medical adviser to get into a condition which in itself is sure to cause death, and which can be averted at a very slight risk by timely operation.

## After-treatment of Prostatectomy

The postoperative treatment of prostatectomy requires the closest attention on the part of surgeons and nurses, for the conditions in the few days after the operation often determine the patient's fate.

It is highly important to have a capable female nurse who is familiar with the after-care of prostate operations, to carry out the many details of treatment and to recognize the danger signals of impending complications.

As soon as the patient is removed from the operating table he should be placed in a well-warmed bed and hypodermoclysis of 1000 c.c. of saline to which 150 c.c. of 5 per cent glucose solution has been added, given in order to start the kidney secretion.

The patient is covered with the electrically heated baker, to keep the surface of the body warm, diminish shock, and encourage perspiration.

If nausea and vomiting are persistent, washing the stomach with a tube is indicated.

Persistent hiccough is at times a very troublesome symptom. The administration of an alkali and atropine or Hoffmann's anodyne will relieve mild cases, but the severe and persistent cases which do not respond to medication are sometimes benefited by washing the stomach.

To avoid the danger of suppression of urine, which causes 35 per cent of the deaths (Watson and Cunningham), the best method at our disposal is the immediate and routine use of the drop method of colonic irrigation as suggested by Murphy.

This should be begun as soon as the patient has recovered from the anesthetic.

A soft-rubber catheter is introduced just within the anal sphincter and attached to a douche bag filled with warm normal salt solution to which may be added with advantage 10 per cent solution of glucose; by means of a clamp on the tube the flow is regulated so that from 20 to 30 drops are delivered each minute into the rectum. This quantity is immediately absorbed, leaving no residue lying in the bowel. To be absorbed, the solution must be kept warm, which can be done by hanging a hot-water bag outside the douche bag. In this way several quarts of fluid can be taken up by the blood vessels in twenty-four hours, and is the best stimulant to the kidneys and diuretic which we possess.

It may be continued until the kidneys begin to secrete freely and for as long as the rectum retains it. Since establishing the practice, almost as a routine, of using the permanent catheter and bladder drainage as a preliminary to operation with the Murphy drip afterward, the author has had a notable reduction in his postoperative deaths from suppression of urine. Indeed, it might be stated that the tripod of safety in prostatectomy is preliminary drainage, rapid operation, and the Murphy drip afterward.

As an additional safeguard the patient should drink water freely, a tumblerful every two hours, as soon as he has recovered from his anesthetic.

A distended abdomen, dry tongue, drowsiness, and scanty urinary secretion are signs that the kidneys are not secreting, and call for prompt, efficient action, for if suppression of urine occurs, death is inevitable.

At the beginning of such an attack the bowels should be moved with calomel and jalap and a high enema containing magnesium sulphate, turpentine, and ox gall administered. The tympanites may be controlled by hormonal or strychnine and eserine hypodermically with an ice bag or turpentine stupes over the abdomen.

Asafœtida in 5-grain pills is useful internally.

Hypodermoclysis with glucose in the solution should be given for its prompt action and the Murphy drip (colonic irrigation) used continuously.

The skin should be encouraged to perspire freely by the electric baker or hot packs.

Under the above outlined treatment in favorable cases the abdomen becomes soft, the tongue moist, the delirium disappears, and the kidneys begin to secrete freely.

Wound infection is confined practically entirely to the suprapubic operation as the perineal approach is free from this complication.

The chance of its occurrence may be minimized by avoiding traumatizing the tissue at the end of operation and not pushing away the cellular tissue at the sides of the bladder and having the drainage tube in place for 5 days to wall off the tissues from the escaping urine.

If infection does occur, it leaves a nasty sloughing necrotic wound which may result in extensive sloughing of the rectus muscles and fascia; and if it reaches the pelvis, may cause pelvic cellulitis from which phlebitis and pyelonephritis are apt to occur. Evidence of infection calls for immediate and free opening and drainage of the field.

A clean, healthy condition of the wound is best maintained by keeping the reaction of the urine acid. This may be accomplished by administering urotropin and benzoate of soda or acid sodium phosphate by mouth and inserting cultures of the lactic acid bacillus into the bladder. In this way the acid reaction of the urine may be caused and maintained.

Epididymitis frequently occurs as a complication following prostatectomy. It is usually unilateral, not very severe, and seldom accompanied by suppuration although occasionally an abscess forms in the cellular tissue outside the testicle which requires incision and evacuation of the pus.

To prevent the occurrence of this complication the vas deferens on both sides is sometimes divided at the time of operation, and it is always well to keep the scrotum and testicles well suspended during the period of convalescence.

Irrigations of the bladder have been entirely discarded by the writer as routine in the after-treatment. It is better not to distend the bladder with irrigation fluids for the distention only disturbs the wound, renders hemorrhages more liable to take place and opens up fresh avenues for infection. After the temperature has been normal for several days, a sudden rise without appreciable cause is often due to absorption from the accumulations of pus and necrotic detritus within the bladder. Free irrigation of the bladder to remove these products causes a prompt subsidence of the fever.

If the cystitis, which is always aggravated by the operation, persists after three or four weeks, bladder washing with silver nitrate 1:4000 is appropriate, and if under this treatment the cystitis is not improved, it should be remembered that it might be continued by the presence of a diverticulum harboring infected urine.

Elderly persons kept in the dorsal position in bed are liable to pulmonary congestion and frequently develop an ether pneumonia after a general anesthetic.

On this account the patient should not be allowed to lie too long on the back after the first twenty-four hours, but should be turned from one side to the other, and they should be encouraged to sit up in bed as soon as their strength permits.

To prevent undue contraction of the newly formed scar tissue about the prostatic urethra and vesical outlet, a No. 30 French sound should be passed after three or four weeks and it is safer to pass a sound occasionally until some months have elapsed and the surgeon is sure that there is no danger of contraction.

## Bottini's Operation

**Bottini's operation** consists in burning channels through the enlarged prostate by means of a specially devised instrument, heated with the electric current, and introduced into the bladder through the urethra. The instrument was devised by Bottini, of Pavia, Italy, and used by him for over thirty years, but never became popular until Freudenberg, of Berlin, made some alterations, which added to its usefulness.

**Description of Instrument.**—The instrument is shaped like a lithotrite, and is provided with a thin platinoiridium blade, which is concealed when the instrument is closed, and is moved backward or forward in a slot in the shaft by turning a wheel at the end of the instrument. This blade is heated to a white heat by means of an electric current conducted to it from a storage battery, through a cord attached to the extreme end of the instrument. All parts of the instrument, except the blade, are prevented from becoming heated by a stream of cold water, which constantly circulates through it.

**Technic of Operation.**—The operation can be done without a general anesthetic, simply using a 4 per cent solution of cocaine injected into the posterior urethra.

In many cases, however, general anesthesia is desirable, and nitrous oxide, ether, or spinal anesthesia may be used, depending on the general indications.

The bladder is first washed with boric acid solution, and is filled either with the solution or with air before introducing the instrument.

Bottini's instrument is introduced into the bladder and hooked up against the projection of the middle lobe. The cold water stream is turned on, and when everything is in readiness the electric current is switched on, a pause of ten seconds is made for the blade to become hot, and then the wheel is slowly turned, causing the red-hot blade to slide out of its place of concealment and slowly burn its way through the tissues of the prostate. After the incision has been made deep enough the wheel is reversed, and the blade slid back into its place of concealment, charring for a second time the tissues of the incision, and then the electric current is turned off.

To secure a thorough charring of the tissues the cuts should be made slowly, allowing about ten minutes for each incision.

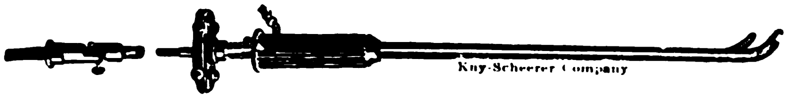

Fig. 238.—Bottini's instrument, as modified by Freudenberg.

During the process of burning, the situation of the beak should be watched, by keeping a finger in the patient's rectum.

After the cut through the posterior lobe is made, it is customary to make two others, in an oblique direction posteriorly and to the right and left sides.

The *length of the incisions* depends upon the size of the prostate, but, as a rule, three centimeters are sufficient for the posterior cut and two centimeters for the lateral cuts.

The *after-treatment* consists in keeping the patient in bed for a few days and administering urotropin, gr. viiss, t. i. d., or salol, gr. v, t. i. d., to sterilize the urine, and strychnine, gr. $\frac{1}{30}$ q. s. h, if the detrusor muscle is weak or atonic

Severe tenesmus and desire to urinate are controlled by morphine, gr. $\frac{1}{4}$ to $\frac{1}{2}$, suppositories.

As retention nearly always follows the operation, either immediately or later, from the swelling of the burned surfaces, Bottini and Freudenberg advise the use of the permanent catheter in preference to passing an instrument; less irritation is caused by tl presence of the catheter, and there is no danger of tearing open the freshly burned surfaces.

Bladder washing is only required in the presence of severe cystitis, and it is not necessary to pass sounds, as the cuts show no tendency to close up. Hemorrhage is a rare accident, but can be controlled by the presence of a large-sized catheter tied in the bladder.

The sloughs usually separate about the eighth to the fourteenth day, and some slight bleeding occurs, and if the operation has been successful in severing the obstruction the urine begins to flow freely.

The maximum of improvement is not attained, however, until after four weeks have passed, as by that time the bladder has recovered its tone to some degree, and the cicatrices in the prostate, formed by the healing of the incisions, have begun to contract and open up the passage.

**Selection of Cases.**—Since the improvements in prostatectomy Bottini's operation has been practically abandoned, but still has a limited field of usefulness in the cases to which prostatectomy is not applicable.

As an anesthetic can be dispensed with, and the operation is accompanied with but little shock, and is, therefore, comparatively free from danger to life, it is particularly adapted to old men who are too debilitated to stand the severe ordeal of a prostatectomy.

Bottini's operation seems peculiarly suitable for the small, hard, fibrous prostates where there is a decided bar at the neck of the bladder, which are difficult to enucleate.

The large adenomatous prostates the size of an apple or larger are better treated by complete enucleation if the patient's general condition will admit of a prostatectomy, and with the suitable proper preliminary treatment nearly all these patients can be so improved that they can stand a prostatectomy.

A reference to the mortality statistics following shows that the death rate is as high after Botinni's operation as following prostatectomy, and, besides the danger to life in many cases operated on by Bottini's method, the obstruction is not relieved or else returns.

On account of the uncertain result and comparatively high mortality, Bottini's operation today is only done in very exceptional cases.

*Results as shown by statistics collected by Burckhardt from patients operated on by Wossidlo, von Frisch, W. Meyer, Stockmann, Freudenberg, and Emil Burckhardt:*

| NO. OF CASES | CURED AND IMPROVED | WITHOUT RESULT | DIED |
|---|---|---|---|
| 960 | 73 to 77 per cent | 14 to 18 per cent | 7 to 10 per cent |

## Excision of Median Prostate Bar by Young's Punch

In a certain number of cases the obstruction to urination is due to a simple bar formation in the median portion of the prostate.

With Young's ingenious instrument this may be divided so that urination becomes free.

"The instrument consists of an outer tube about 18 cm. long with a coudé curve at its inner end and a urethroscopic disc at the other, containing a post on which an external urethroscopic light can be attached. Near the inner end of the under surface a large, deep fenestra is provided. Within the instrument is a second tube which has a sharp-cutting inner end made of steel, which when pushed home can excise anything appearing inside the outer tube. The object of this instrument is, when pushed through the urethra into the bladder, to engage the median bar in the fenestra and then to excise it by means of the inner cutting tube while observing the operation through the inner tube illumined with the external urethroscopic lamp." **This is** followed by continuous irrigation for from twenty-four

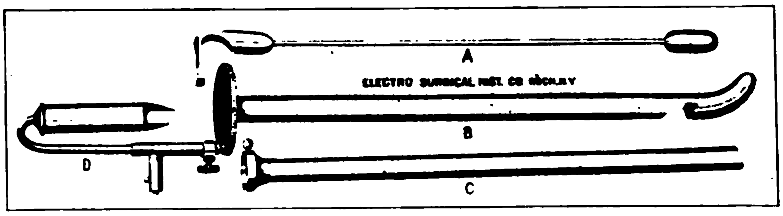

Fig. 239.—Urethroscopic median bar excisor. (*A*) Obturator. (*B*) Outer fenestrated tube for catching the median bar. (*C*) Inner sharp cutting tube for excising the median bar. (*D*) External illumination.

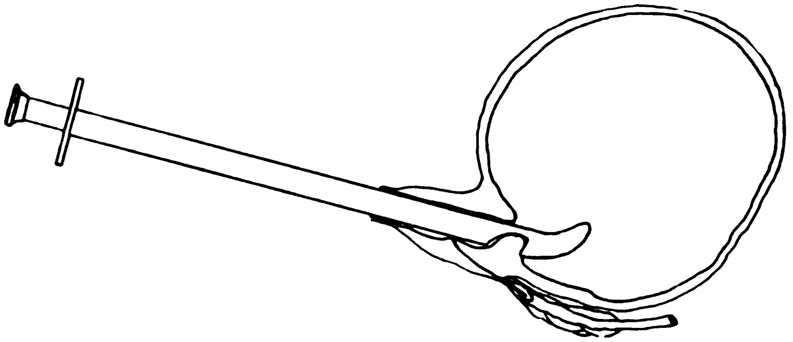

Fig. 240.—Incisor in place, hooked over the median bar of the prostate.

eight hours through a two-way catheter and usually gives relief with rapid convalescence.

On account of the hemorrhage which sometimes follows the incision, Hagner advises a preliminary external urethrotomy, through which the punch is introduced and operated. Any resulting hemorrhage can be controlled by a perineal tube and firm gauze packing.

## Palliative Operations

In these operations no attempt is made to remove any portion of the prostate. They are done for the sole purpose of draining the bladder, treating the cystitis, and avoiding catheterization.

The bladder may be drained by means of a

(*a*) Perineal opening. (*b*) Suprapubic cystotomy.

The perineal incision is the operation of choice when it is desired to drain the bladder *temporarily* for the sake of giving a respite to the urethra which has been irritated by the hourly passage of a catheter, or to remove blood clots from the bladder which have originated from hemorrhage into its cavity.

In cases of severe and obstinate cystitis the perineal opening and continuous drainage serve to clear the bladder from the thick mucopurulent urine and to restore the vesical mucous membrane to a healthy state and the urine to its normal *acid* reaction.

The perineal incision is a very slight operation, especially if done under cocaine inside and under the skin of the perineum, or nitrous oxide anesthesia,

The prostatic urethra is stretched and dilated with the finger at the same time, and a large catheter is introduced through the wound and kept in the bladder for from one to three weeks, draining it of its residual urine and allowing it to be washed out and kept clean and aseptic.

The drainage of the bladder gives great comfort. The patient is not aroused from sleep every few minutes to pass water. The tenesmus and pain on urination are no longer felt, the cystitis subsides, the prostatic edema lessens, the secretion of urine becomes freer, and the urinary fever and toxemia subside. After a week or two of drainage and the patient's general condition has greatly improved, the perineal opening can be utilized, to enucleate the prostate by means of the finger. It only requires a whiff of ether or nitrous oxide, and in two minutes the prostate can be removed by the intraurethral enucleation method, and the case subsequently be treated on the lines laid down for a prostatectomy.

In cases which are better adapted to a suprapubic prostatectomy the preliminary drainage may be conducted from above.

**Suprapubic Cystotomy.**—An opening made into the bladder above the pubes gives an opportunity to inspect the cavity of the bladder and remove a calculus if present, and if the stone happens to be in a saccular dilatation it can never be found in any other way.

As the condition of these patients is always desperate, and the operation is only undertaken as a last resource, it is important to avoid giving a general anesthetic, if possible.

Rovsing therefore uses local anesthesia, by means of cocaine solution injected under the skin over the bladder, which gives enough insensitiveness for the purposes of the operation.

The suprapubic fistula answers very well as a permanent opening and is more easily managed by the patient than the perineal opening. A Pezzar catheter, No. 25 French, is arranged to pass through the fistula in the abdominal wall, into the bladder, siphon off the urine, and allow it to flow into a reservoir under the clothing. The patient wearing such an apparatus is able to be up and about, even to take long walks and enjoy a fair amount of activity.

In every case of enlarged prostate, however, rather than allow the patient to go indefinitely with a permanent suprapubic fistula, it is far better to enucleate the prostate with the finger through the supra opening, as soon as condition will allow it.

In cases of suprapubic drainage a frequent cause of death is gangrene of the suprapubic wound and general sepsis, and for that reason, where the permanent catheter can not be tolerated in the urethra and drainage through an incision must be employed as a preliminary to prostatectomy, the author prefers the perineal route.

## BIBLIOGRAPHY

Albarran, J.: Med. op. Voies Urinaires, 1909.
Bottini, E.: Arch. f. klin. Chir., liv, No. 1.
Bryson, J. P.: St. Louis Med. Rev., Feb. 22, 1902.
Cunningham, John H.: Boston Med. and Surg. Jour., May 9 and 16, 1907; Ann. Surg., April, 1905; ibid., May, 1917.
Freyer, P. J.: Diseases of the Urinary Organs, 1908.
Fuller, Eugene: Ann. Surg., May, 1903.
Kolischer, G.: Jour. Am. Med. Assn., June 6, 1912.
Moony, M.: Urol. and Cut. Rev., 1917.
Rathbun, N. P.: New York Med. Jour., May 19, 1917.
Squier, J. Bentley: Jour. Am. Med. Assn., Feb. 24, 1917; Surg., Gynec. and Obst., Sept., 1911.
Watson, Francis T.: Ann. Surg., May, 1903.
Young, Hugh: Tr. Assn. G. U. Surgeons, 1909; Jour. Am. Med. Assn., Feb. 15, 1908; ibid., Feb. 17, 1917; Johns Hopkins Hosp. Reports, 1906, xiv.

# CHAPTER XXVIII

## CARCINOMA OF THE PROSTATE

The importance of cancer of the prostate has only been appreciated since the operations for hypertrophied prostate in old men have come into general use. Albarran and Hallé state that fourteen out of every one hundred prostates removed at operation show evidence of carcinoma. Statistics show the Johns Hopkins Hospital 28 per cent and the Mayo Clinic 15.5 per cent of carcinoma found in prostates removed for hypertrophy.

Carcinoma may originate *de novo* in a normal prostate, but it usually occurs as a degenerative change in an ordinary adenomatous hypertrophied prostate, and at the commencement the process is confined almost invariably to the posterior lobe.

Clinically the disease may occur as a small area of stony hardness which merges imperceptibly into the adenomatous hypertrophy of the gland. After existing for some time in this stage it slowly involves the whole gland, filling up the entire prostatic capsule.

About this time the capsule of the prostate becomes adherent to the anterior pelvic fascia on the fascia of Denonvilliers and the perirectal fascia, but the rectal tissues are no longer movable upon the prostate and it has become fixed and immovable in the pelvis.

Finally the carcinomatous tissue bursts through the capsule and spreads into the pelvic cellular tissue surrounding the vesiculæ seminales and extending to the lateral walls of the pelvis and space of Retzius or it may grow upward into the bladder, forming a large fungating cauliflower-like tumor.

In most cases of carcinoma of the prostate which last for some time, metastatic deposits in remote organs occur. The favorite seat of metastasis is in the *bones* and in every case which appears to be a primary carcinoma of a bone the prostate should be examined for cancer.

The lymph glands of the pelvis and retroperitoneal tissue and the liver and lungs are also frequently the seat of metastatic deposits.

### Symptoms and Course

So long as the carcinoma is confined within the prostatic capsule the symptoms are those of an enlarged prostate and are obstructive in character, but are more severe and run a more rapid course.

After the disease has progressed, there is a loss of strength, emaciation and pain in the back, neuralgia along the course of the sciatic, obturator or crural nerves, with evidences of metastases in the bones or other organs.

Localized edema occurring about the pelvis, the rectum or the lower extremities independent of renal or cardiac disease especially if accompanied by pelvic pain or vesical irritability, would suggest carcinoma of the prostate, with metastasis in the pelvic lymph glands and pressure on the iliac veins.

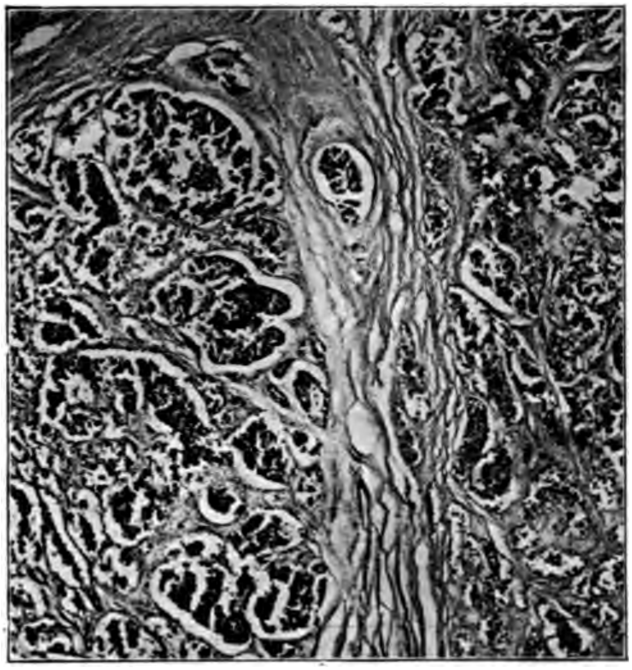

Fig. 241.—Adenocarcinoma of prostate showing epithelial nests.

The disease may progress rapidly, with a duration of six months or a year, but in other cases the course is very chronic and may last three or four years or even more.

Metastases may take place before the carcinoma has broken through the prostate capsule, but usually occurs after the rupture.

When this takes place the pain ceases suddenly on account of relief to the nerve pressure.

The carcinoma infiltration spreads to the seminal vesicles and pelvis and later on the posterior wall of the bladder, by way of the ejaculatory ducts and accompanying lymph channels.

As the disease progresses the obstruction to urination becomes greater and the debility and cachexia increase and the patient finally dies from ascending infection of the kidney and pyelonephritis or from the interference with nutrition or from the cachexia induced by extension secondary metastatic deposits.

## Diagnosis

When the cancerous growth consists only of a small nodule imbedded in the adenomatous tissue of a hypertrophied prostate, the diagnosis is only possible by a microscopic examination of the prostatic tissue removed at operation, and every hypertrophied prostate which is taken out should be subjected to this diagnostic test, for by the gross appearance alone of a prostate it is impossible to decide if it be simple adenoma or complicated by carcinoma. The accompanying picture of a prostate illustrates this very well, for to all appearances the prostate is a purely benign growth, and only upon microscopic examination was it found to be otherwise.

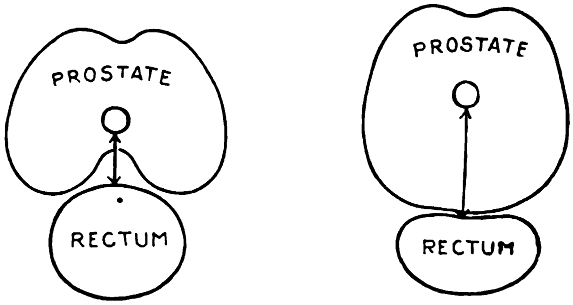

Fig. 242.—Differential diagnosis between senile hypertrophy and carcinoma of prostate, showing thickening of posterior lobe in carcinoma.

When the growth is larger a stony nodule may be felt in the prostate on rectal palpation, and if more extensive the prostate is irregularly enlarged, nodular, and of a stony hardness, and, instead of being freely movable on bimanual examination, is firmly fixed to the surrounding tissues.

In certain cases masses of enlarged lymphatic glands may be felt, sometimes at remote distances, and search should be made for metastatic deposits especially in the bones.

Geraghty has called attention to a simple means of making a diagnosis. A sound is introduced into the urethra and the surgeon's finger in the rectum to estimate the amount of thickened tissue between the posterior surface of the prostate and the urethra.

In a simple adenomatous prostate the bridge of tissue is very thin, but in a cancerous enlargement the amount of tissue between the finger and the sound is very much thickened and often stony hard.

Kidd describes a peculiar sensation which is felt when a sound or cystoscope is passed into the bladder through the urethra which he describes as a dry grating, as the instrument is gripped in the deep urethra. Cystoscopic examination fails to disclose any characteristic change which would not occur from a hypertrophied prostate, unless in the late stages, when the growth has perforated into the trigone and formed an ulcer.

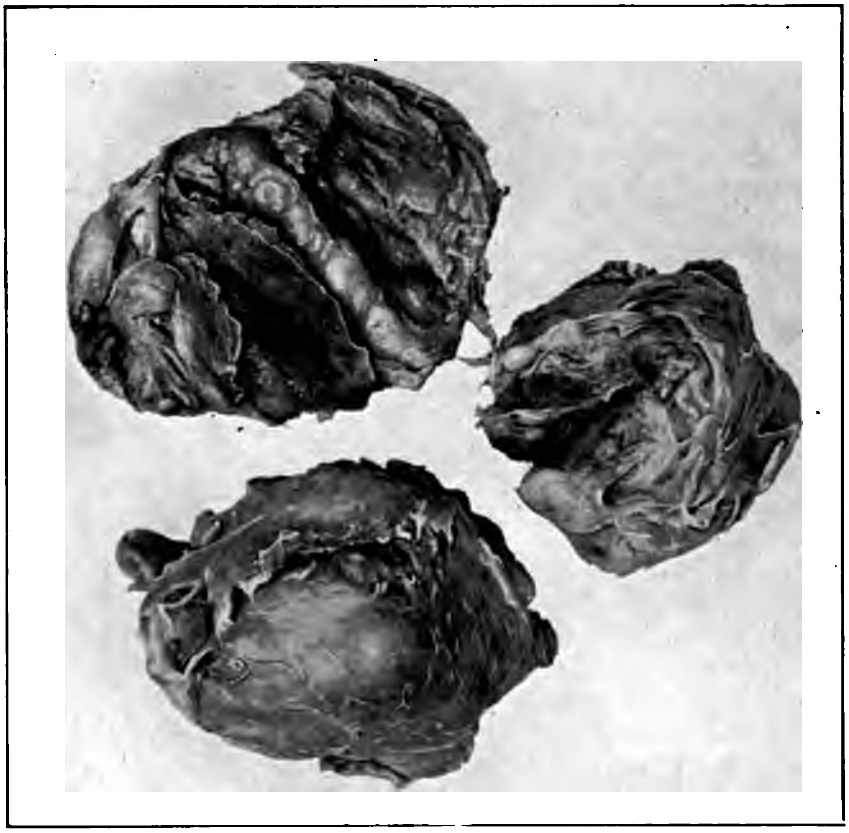

Fig. 243 Adenocarcinoma of the prostate removed by suprapubic prostatectomy. Operated twelve months ago and still free from recurrence. (Author's case.)

When the ulcer begins to break down, the author has observed a deep cavity in the substance of the prostate, bleeding freely on rectal examination.

### Differential Diagnosis

**Carcinoma of Prostate.**—Rectal examination: Often fixed and immovable in pelvis. Lumpy and irregular with areas of stony hardness.

Metastases in bones, glands and other organs.

**Chronic Gonorrheal Prostatitis.**—Rectal examination: Softer and less nodular.

Pus in expressed secretion.

Positive complement-fixation test.

**Tuberculous Prostatitis.**—Rectal examination: Small hard nodules scattered about on surface.

Positive von Pirquet.

Epididymis and kidney often seat of tuberculosis.

**Calculus Imbedded in Parenchyma of Prostate.**—One lobe stony hard.

X-ray shows shadows of calculus.

**Senile Hypertrophy.**—Elastic in consistency and regular in outline.

Above are all freely movable in pelvis.

### Treatment

In many cases of hypertrophied prostate which after enucleation showed a carcinomatous nodule, the removal has been complete and the patients have lived a long time without showing any recurrence. This fact may be well cited as an additional reason for advising early operation in cases of hypertrophied prostate.

From the statistics quoted in the foregoing section, it is evident that a cure may be obtained in cancer of the prostate complicating senile hypertrophy by an ordinary prostatectomy.

In these cases the diseased condition is only diagnosed after the removal of the gland. Unfortunately after the disease has progressed to the point where it is possible to make a diagnosis by palpation, the infiltration is so extensive that the chance of a complete removal by operation is very slight.

When the disease is still limited to the capsule of the prostate, and before the gland has become fixed and immovable, Hugh Young has devised an operation by which the urethra, prostate, a portion of the bladder, and the vesicles are removed in one piece by dissection through a perineal incision and the cut urethra afterward united to the bladder.

To be successful the patient must be in good condition to stand a protracted operation, and the disease must not have extended beyond the prostatic capsule.

As most of the cases apply for relief after the chance of successful operation has gone by, the surgeon must content himself with palliative treatment, deferring the catheter life as long as possible to avoid the inevitable cystitis, and when the catheter no longer relieves by establishing a permanent suprapubic fistula for drainage.

In very recent times the action of radium has been found to be of great use in cases of carcinoma of the prostate. While it may not be curative, it certainly retards the growth and progress of the carcinoma, the tumor becomes softer and smaller in size and the obstruction of the prostate at the bladder outlet is reduced, so that urination becomes freer.

The effects of radium seem to promise more than attempts at operative removal after the disease has progressed to the point where a diagnosis can be made by palpation, in delaying the progress of the disease.

### BIBLIOGRAPHY

Barringer, B. S.: Jour. Am. Med. Assn., April 28, 1917.
Fuller, Eugene: Tr. Am. G. U. Assn., 1912.
Geraghty, J. T.: Tr. Am. G. U. Assn., 1912.
Kidd, Frank: Urinary Surgery, London, 1910.
MacGowan, Granville: Jour. Am. Med. Assn., Feb. 17, 1917.
Pasteau, O.: Arch. Roentg. Ray, 1915.
Young, Hugh: Johns Hopkins Hosp. Reports, 1906; Ann. Surgery, Dec., 1909; Jour. Am. Med. Assn., lxix, 1917.

# CHAPTER XXIX

## TUBERCULOSIS OF THE PROSTATE

The prostate is involved in nearly every case of genitourinary tuberculosis. Of 26 cases of tuberculosis of the prostate reported by Socin, in 24 of them other genitourinary organs were affected and only in 2 did the genitourinary apparatus escape. In these two instances the lungs and bones were the seat of tuberculous deposits.

Although Sir Henry Thompson denied that the prostate could ever be the seat of *primary tuberculosis*, later investigators have proved conclusively that it may be, and Desnos and Krzwicki even go so far as to state that, in their opinion, in most cases of genitourinary tuberculosis the prostate is the organ which is first infected with tubercle bacilli, and from that focus the infection subsequently travels to the adjacent structures. This point is important to bear in mind in connection with the operative treatment, which will be considered later.

The *time of life* at which tuberculosis is most apt to fasten upon the genital organs is that period at which sexual activity is most highly developed, and consequently we find that our patients are usually between twenty and forty-five years of age.

*Predisposing causes* play an important role in the etiology of tuberculosis of the prostate. Anything which induces prolonged and oft-repeated congestion of the posterior urethra weakens the resistance of the tissues; consequently, a tuberculous outbreak is more liable to occur in the person of a young man who has practiced some form of sexual abuse or has been the subject of a prolonged attack of gonorrhea of the posterior urethra. But this in itself is not sufficient to cause the disease, and, to bring this about, the tubercle bacilli must be actually introduced into and develop in the substance of the gland.

As to the modes of infection, the microorganisms are most frequently brought to the prostate in the blood circulation, often from a tuberculous deposit in some distant organ. In other cases they may be taken into the body through the respiratory or alimentary tracts, and passing along with the blood current, be ultimately deposited in the prostate.

The inoculation of bacilli, however, may be direct, and be occasioned by an infected catheter or through coitus with a tuberculous female, or the prostate may be infected by a process of extension from some neighboring organ.

## Pathology

A tuberculous deposit takes place in the substance of the prostate, and either one or both lobes are affected. The tubercular nodules are multiple from the beginning, or else soon become so, and they enlarge until several coalesce, when they break down and form abscesses.

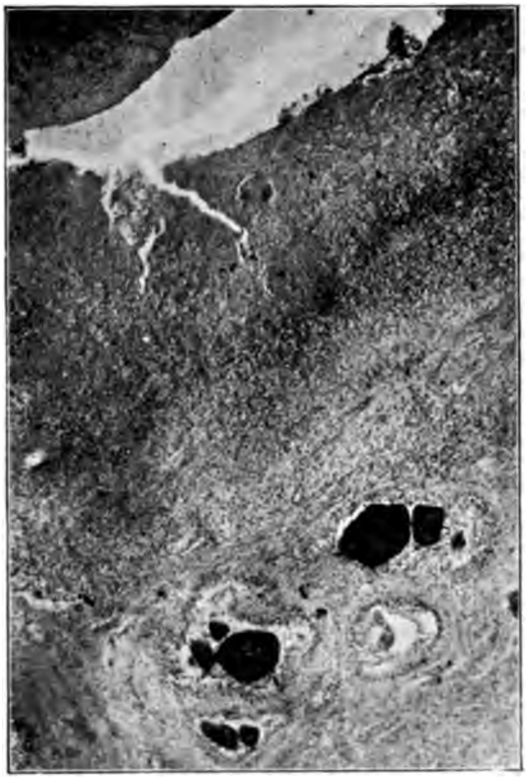

Fig. 244.—Tuberculosis of prostate. Margin of caseation.

Unless removed by operation, the pus bursts through into the rectum or urethra or even the hypogastrium, and multiple fistulous tracts are formed. In rare instances the cheesy mass becomes the seat of calcareous changes, or the fluid portion of the mass is absorbed and the residue is encapsulated, and a healing of the lesion results.

It is important to note that the bladder and seminal vesicles are always involved sooner or later in the course of the disease. The epididymis is also affected, although in many cases this organ is the first attacked, and the infection extends to the prostate subsequently.

## Symptoms and Course

If the process begins in the central part of the prostate, no definite symptoms are caused; but if the nodules are located superficially, and cause a bulging of the prostate toward the rectum, a sense of weight in the perineum and difficulty in defecating is experienced.

If, on the other hand, the tuberculous foci lie close to the urethra, the symptoms are those of posterior urethritis; viz., frequent and urgent urination, accompanied by a mucopurulent discharge from the urethra and shreds in the urine.

There is no distinct pain after the act of micturition, but a feeling as though the bladder were not fully emptied.

Defecation spermatorrhea sometimes occurs if the deeper lying prostatic tubules are infiltrated with nodules. Another form of secretion from the meatus is occasioned by the breaking down and discharge of small abscesses through the urethra.

Hematuria is a frequent symptom, and is not constant, but intermittent. The blood comes at the end of urination, and is not due to an ulceration of the urethra, as formerly supposed, but merely to the congestion of the prostate.

In uncomplicated cases *pain* may be excruciating, and is sometimes so severe that it overshadows all the other symptoms.

As the disease progresses, the bladder is always affected. This is announced by the occurrence of pain after urination and tenesmus, and as the cystitis grows worse the bladder symptoms become the marked feature in the case.

In most cases of tuberculous prostatitis, death is caused by an ascending infection, involving first the bladder and subsequently the kidneys, or the lungs may be attacked, or a general miliary tuberculosis may be established.

In a few rare instances the disease remains limited to the prostate; an abscess forms, which breaks and discharges, the cavity cicatrizes, and a cure follows.

## Diagnosis

On rectal examination the tuberculous prostate will be found enlarged in one or both lobes. The enlargement is distinctly nodular or lumpy, and at first of a stony hardness. After the abscess forms, points of softening with fluctuation can be readily felt.

It is often extremely difficult, indeed sometimes impossible, to determine whether the enlargement is in the prostate or involves the seminal vesicles, for these different organs may be so blended together by the inflammatory exudation that the lines of demarcation can not be defined. On this account it was formerly supposed that every tubercular process in this region was confined to the prostate, whereas we now know it to be true that the tuberculous process may attack prostate and vesicles together, or either organ be involved alone.

The gonorrheal inflammations of the prostate, chronic prostatitis, or the acute suppurative form resembles in physical signs the tuberculous disease, and it is impossible definitely to establish the diagnosis of tuberculosis until the presence of tubercle bacilli has been demonstrated in the secretions. These may be collected by expressing, with the finger in the rectum, the secretions from the prostate gland, and the bacilli are also generally present in the discharge from the meatus which so often exists.

If no tubercle bacilli are found in examining the secretions, guinea pigs may be inoculated with the discharges, and, if the pig develops tuberculosis, the diagnosis is, of course, established.

In cases of general tuberculosis it is usually safe to consider every enlargement of the prostate tuberculous in character, and the only difficulty in diagnosis arises in the cases where the prostate is the seat of primary tuberculosis.

### Prognosis

The prognosis is, of course, of the gravest, although when the tuberculosis is limited to the prostate alone spontaneous cure sometimes occurs through healing of the cavity after the abscess has formed and burst.

Unfavorable elements in the case are an hereditary predisposition to tuberculosis and a tendency for the disease to extend and involve other organs.

### Treatment

The general treatment consists in endeavoring to vitalize the tissues by means of a life in the open air or a prolonged sea voyage, abundance of nourishing food, and the administration of cod liver oil, creosote, guaiacol, and other antituberculous remedies.

There is a difference of opinion as to the advisability of beginning local treatment early. In general, it is better to avoid inst tion, for the reason that the local resistance of the tissues is reduced, and infection of the bladder with other microorganisms readily occurs.

On the other hand, instillations into the posterior urethra in the early stages have their advocates. Guyon advises corrosive sublimate solution, 1:5000 to 1:3000, and iodoform in glycerin is warmly recommended by Berkeley Hill. Everyone is agreed that nitrate of silver uniformly acts badly, and its use is contraindicated.

After cystitis has set in, the principal indications are to control the pain and tenesmus, but these matters have been considered in another section. (See Cystitis.)

Under the head of **operative treatment** may be considered, first the suggestion of Hoffmann, which was to inject 10 per cent emulsion of iodoform and glycerin into the substance of the prostate by means of a long needle thrust in through the perineum. This procedure has never gained favor, and is today practically abandoned.

A few years ago, when the *dictum* of Sir Henry Thompson, that "tuberculosis of the prostate was never primary, but always secondary to deposits elsewhere," was accepted as final, it was thought useless to attempt to extirpate the diseased prostate, and the rule was only to operate when pus had formed, in order to evacuate the contents of the abscess.

At the present time the opinion has changed, and the operation of laying bare the prostate by a semilunar incision, curving around the rectum and removing all the diseased tissue with a curette, commends itself as a rational and conservative procedure, and one which is likely to bring about a radical cure when the disease is limited to the prostate alone.

When the prostate is secondarily affected and deposits exist in the epididymis or kidney, as is nearly always the case, operative interference with the prostate is quite out of the question, but if the kidney or testicle be removed the secondary deposit in the prostate usually clears up and disappears.

The spontaneous healing of the local focus may be aided by the use of tuberculin injections.

# CHAPTER XXX

## MOVABLE KIDNEY

An unnatural movability of the kidney occurs in two forms:

(*a*) **Movable kidney** is more frequent in its occurrence. In this variety the kidney moves about freely behind the peritoneum, as it lies in a sort of pouch or cavity formed within its own fatty capsule.

(*b*) **True floating kidney** lies closely surrounded by its fatty capsule, and is supplied with a mesonephron, which is attached by one end to the spinal column, but which is so long that it allows the kidney to float about freely in the peritoneal cavity. The extent of the excursions of the kidney depends only upon the length of its mesonephron.

### Etiology

Movable kidney occurs more frequently in females than in males, Lindner finding that one out of every five or six women examined was so affected, and the right kidney is more frequently movable than the left.

True floating kidney is either caused by a congenital mesonephron or it may exceptionally be the last stage of a movable kidney.

Various reasons are suggested for the preponderance of movable kidney in the female, the chief of which are laxity of the abdominal walls as a result of childbearing. On closer scrutiny, the facts do not uphold this theory, for a movable kidney is found as often among virgins and nulliparæ as among women who have borne children.

It is probable, however, that the cause of movable kidney in both sexes is the absorption of the fat which surrounds the kidney and acts as a cushion and support to it, as a consequence of the emaciation occurring in wasting diseases.

If the fat is absorbed, a slight blow or muscular strain, such as the exertion of vomiting, may be enough to loosen the kidney from its attachment and permit it to move about more or less freely.

### Symptoms

The symptoms of movable kidney are, of course, obscure. **G** intestinal symptoms, such as flatulence and dyspepsia, are **ge** present, and have been accounted for by the supposition that the kidney in its abnormal situation exerts pressure upon the duodenum and narrows its lumen, thus causing partial retention and fermentation of its contents.

These symptoms are due to pressure and traction upon or stretching and irritation of fibers of the solar plexus, lying in the abdomen and belonging to the sympathetic nervous system, because it would seem that the theory of obliteration of the lumen of the duodenum is insufficient to account for the symptoms.

The other symptoms which are generally caused by floating kidney are as follows: Pain is felt in the epigastrium, which is not increased by pressure, and is located somewhere to the left of the median line at or near the free border of the left costal cartilages. General nervousness in greater or less degree exists, and is usually accompanied by cardiac palpitation and habitually rapid action of the heart.

These patients are also unable to sleep or to rest comfortably while lying upon the left side.

In true floating kidney with a long mesonephron, in addition to the presence of the above-mentioned disturbances, the patient is conscious of abdominal pains, of a dragging or pulling character, and the sensation is felt as if some foreign body were moving about in the abdominal cavity, particularly after a sudden muscular exertion, or upon rising up suddenly after lying down.

Nervous disturbances, hypochondria, melancholia, and hysteria usually occur, either as reflexes or from disturbances of nutrition. The secretion of urine by the misplaced kidney is, in general, not interfered with, although from the twisting or kinking of the ureter a condition of hydronephrosis is often induced.

Patients with a movable kidney always suffer more or less from pain, which may be wearing in character or may occur in paroxysms and be agonizing if the kidney is twisted on its pedicle, causing kinking of the ureter.

The paraoxysmal attacks are known as Dietl's crisis after the surgeon first describing them.

The onset generally is sudden. Sickening pain and collapse might be called the cardinal symptoms. The pain is violent and radiates from the kidney toward the bladder, though bladder disturbance is uncommon. The collapse is alarming, accompanied by chills, sweats, pallor, weak, rapid pulse and shallow respiration. Nausea, with or without vomiting, is almost constant. Later the temperature may be slightly elevated, as a result of kidney inflammation.

Such a condition may last for a few minutes or an hour and later the kidney may be felt as a tender rounded mass, and if the condition is prolonged, pus, blood and casts may be found.

### Diagnosis

The diagnosis is not difficult to make in thin subjects with relaxed abdominal walls. By palpating the flank between the fixed border of the ribs and the crest of the ilium the displaced kidney can be felt between the two hands.

In fat subjects the diagnosis presents greater difficulties. If the kidney has been displaced into the pelvis, it may be mistaken for an ovarian or fibroid tumor; but the kidney may be differentiated by replacing it with ease in its natural position in the flank, while the attachment of its mesonephron prevents its complete descent into the pelvis.

If the mesonephron is shorter and the kidney is found lying in the abdomen, it might be looked upon as a distended gall bladder, enlargement of the spleen, or a tumor of the omentum.

Pyelography is of great assistance in making the differential diagnosis between floating kidney and other conditions.

A radiogram of the pelvis of the kidney filled with thorium solution readily demonstrates the relation of the pelvis of the kidney to the tumor.

### Prognosis

A kidney which once becomes movable never again becomes firmly fastened in place, except by operative interference.

A misplaced kidney, however, is, in general, not fatal to life, and, if death occurs, it is usually the result of exhaustion from chronic dyspepsia, continued pain, and nervous depression, although death is sometimes due to malignant disease developing in the displaced organ.

The principal danger which a patient with movable kidney is liable to, is that of interference with the flow of urine through the ureter and the development of a hydronephrotic kidney.

### Treatment

The symptoms of movable kidney may be ameliorated by lying in bed, by the Weir Mitchell treatment, and by massage and electricity.

but none of these methods offers much prospect of permanent relief.

A simple bandage of elastic webbing without any pad over the kidney, and which, encircling the whole abdomen, makes as much pressure as the patient can comfortably bear, helps to support all the abdominal viscera and with them the kidney. Such a method may be tried before proceeding to operation, but it is generally found to be ineffective in holding the kidney in place.

On account of the difficulty of retaining the kidney in position by a bandage nephropexy, or fixation of the kidney, is advised as the first resort in patients with movable kidneys which produce decided symptoms.

Nephropexy is an operation which is not attended with much danger to life, and it is generally successful in fixing the kidney and relieving the symptoms. Delvoie reports 215 cases operated on by fixation, of which 135 were cured, 30 improved, 25 unimproved, 20 relapsed, and 5 died.

Howard Kelly summarizes the indications for operation in floating kidney as follows: Operation is demanded when there are evidences of obstruction, pain and increased size of the kidney pelvis.

The size of the kidney pelvis and degree and position of the displacement are determined by catheterizing the ureters and filling the pelvis of the kidney with thorium solution and taking a radiographic picture. Enough thorium should be allowed to flow into the kidney pelvis to cause a little pain, which denotes distention of the kidney pelvis. Kelly seldom finds it necessary to fix the kidney on both sides, as the mobility is usually unilateral.

In cases of true floating kidney with a long mesonephron, it may be impossible to fix the kidney in place. Such a contingency would demand nephrectomy by the lumbar incision if possible, and, if this is not practicable, by means of a laparotomy, although the mortality is much higher with the abdominal route than when the kidney is removed through the flank and without opening the peritoneal cavity.

# CHAPTER XXXI

# SUPPURATION OF THE KIDNEY AND ITS PELVIS

Two general groups of disease of the kidneys are recognized today.

The first group consists of an inflammation of the secreting tubules (parenchymatous nephritis) or interstitial connective tissue formation between the tubules. These are strictly medical cases and are considered in the department of internal medicine.

The second group is of interest to genitourinary surgeons and consists in the suppurative inflammations of the kidneys and its pelvis, which may be classified as follows:

First. Pyelitis, which is a suppurative inflammation of the pelvis of the kidney without involvement of the parenchyma.

Second. Pyelonephritis, which is an inflammation of the pelvis of the kidney, to which are added small abscesses in the parenchyma of the kidney itself.

Third. Pyonephrosis. Here there is a destruction of the renal tissue by abscess formation, together with dilatation of the pelvis of the kidney, and a filling of its cavity with pus.

## Etiology

There are certain well-recognized predisposing causes for these conditions. Anything which obstructs the outflow of urine and permits residual urine to accumulate, either in the bladder, ureter or pelvis of the kidney, tends to bring about this condition. In the bladder hypertrophied prostate, stricture, calculus and tumors all interfere with the emptying of the organ and make for the accumulation of residual urine. Kinks in the ureter, a movable kidney, or stricture of the ureter are frequent causes; and in the kidney or its pelvis renal calculus and tuberculosis are followed in time by suppuration.

As in conditions elsewhere the exciting cause of the suppurative inflammation is always bacteria, of which the colon bacillus is responsible for 75 per cent of the cases, but staphylococcus, streptococcus, the proteus bacillus pyocyaneus, gonococcus and the tubercle bacillus all play their role in inducing suppuration at times.

**Mode in Which Organisms Reach the Kidney.**—Organisms may make their way from the bladder to the kidney by ascending infection, or by means of the blood current—the so-called hematogenous or hemic infection.

There is some difference of opinion as to the manner in which organisms reach the pelvis of the kidney from the bladder. It is supposed by some that they make their way through the lymphatics of the ureter; by others that they spread by continuity along the walls of the ureter.

It is difficult to conceive that bacteria should be able to ascend against the tide or outflow of urine through the ureter, but in cases of residual urine with dilated ureters and a stagnant column of urine in them, with the patient in the recumbent position it may easily be possible for the bacteria to make their way upwards through the nonmoving column of urine to the pelvis of the kidney.

The hematogenous infections are better understood, for here it is known that the organisms can be conveyed from any focus of suppuration through the blood current and deposited in the glomeruli of the kidney, where, if they are not eliminated, they remain and start foci of suppuration.

## PYELITIS

A simple pyelitis without involvement of the pelvis of the kidney may be unilateral, although in the later stages of the ascending infection it is usually bilateral, both kidneys being affected, although not to the same degree.

### Pathology

The process begins as a catarrhal inflammation of the mucous membrane of the pelvis, which becomes hyperemic, thickened and velvety. After it has been the seat of a chronic inflammation for some time petechial spots and superficial ulceration occur. In longstanding cases the wall of the pelvis is thickened, leathery and the mucous membrane is dull and opaque.

The symptoms of calculus and tuberculosis will be considered later.

### Symptoms

The symptoms of pyelitis are not marked and the condition may exist for a long time without giving rise to the suspicion of its presence. In acute cases there is a slight temperature at night, but chronic cases run their course without fever. Frequency of urination is always present and is occasioned by the polyuria which exists.

The patient complains of a vague pain or heavy feeling in one or both loins and tenderness on pressure at the angle of the twelfth rib, the chief symptom, however, being cloudiness of the urine, caused by pus in the urine.

### Examination

On palpation of the kidney slight tenderness is noted at the angle of the twelfth rib, and on striking with the flat of the hand at this spot severe pain is complained of (Murphy's sign). In uncomplicated cases the kidney is not enlarged. The urine is abundant, of low specific gravity and contains pus, epithelium from the pelvis of the kidney, blood cells and hyaline and granular casts.

### Differentiation from Cystitis

In cystitis the quantity of urine is not increased, the reaction is generally alkaline, unless due to colon or tuberculosis, and the amount of albumin corresponds to the pus and blood. There is no renal pain or tenderness over the kidney. Microscopic examination shows pus and bladder epithelium.

In pyelitis the quantity of urine is increased, the specific gravity is low and the sediment does not coagulate as quickly as in cystitis, but remains floating as a hazy cloud in the urine. The reaction of the urine is acid, microscopically shows a few epithelial cells and those from the pelvis of the kidney and generally show colon bacilli, staphylococci, or streptococci.

For absolute differentiation cystoscopy, catheterization of the ureters, pyelography, kidney functional tests and animal inoculation are indispensable.

The radiograph as used in pyelography is the best means of making the diagnosis, for in every case of pyelitis of long standing the pelvis of the kidney is enlarged, its capacity increased, and pyelograms always show an increase in size.

It should be decided by the above-mentioned methods whether pyelitis is present as a complication in all cases of cystitis, and if pyelitis does exist whether it is bilateral or unilateral, and also whether it is caused by calculus, tuberculosis or movable kidney.

### Treatment

In acute cases rest in bed is immediately called for. The patient should drink freely of water, to dilute the urine and wash out any debris that may have been deposited in the pelvis of the kidney, whether bacteria alone or pus, mucus and bacteria. If the urine is very acid, especially if there is irritability of the bladder, it may be well to give an alkali such as citrate of potash in 30-gram doses for a short time, but it should not be given for a long period of time, nor should the urine be allowed to remain alkaline for long as most organisms grow better in an alkaline medium. After the urine has been alkaline for a couple of days the citrate of potash should be stopped and urotropin administered, for this is the best antiseptic for the urinary organs. The dosage should be from 7½ to 20 grains three times a day. Larger doses are more efficient as germicides, but sometimes cause urethral pain and bladder irritation. The bowels should be moved freely every day to remove the focus of colon bacilli absorption, and the diet should be one which tends to cause the least intestinal fermentation.

Under this treatment acute cases usually get well in the course of a few weeks, unless the predisposing cause is still present.

In the treatment of chronic cases the first indication is to remove the cause and give free drainage to the bladder and pelvis of the kidney. Any local irritant, such as a calculus, or anything which tends to obstruct the flow of urine from the bladder and cause back pressure on the ureters and pelvis of the kidney, should be removed, for free drainage along the whole urinary tract is of the utmost importance. The free drinking of water, to flush the pelvis of the kidney, and the use of urotropin should be continued as adjuvants. An autogenous vaccine is often of benefit in aiding the patient's natural powers of recovery. In chronic cases, however, the main dependence of the treatment is the local measures. If drainage of the bladder is free, drainage of the pelvis of the kidney should be provided for by passing a ureteral catheter into the pelvis of the kidney and evacuating the pus and microorganisms which would otherwise accumulate there. After remaining *in situ* for three or four days, the ureteral catheter should be removed for twenty-four hours and reinserted for an equal length of time. In addition to drainage of the pelvis of the kidney, washing of the pelvis of the kidney with nitrate of silver solutions should also be employed. The solutions ordinarily in use are nitrate of silver 1:1000 to begin with and increased to 1:500. The pelvis of the kidney should be washed out with these solutions once every day or every second day.

It is often very gratifying to observe the effects of drainage by the ureteral catheter and lavage of the pelvis of the kidney in chronic cases.

After a thorough trial of these measures if the case is still intractable, the question of nephrotomy and drainage should be carefully considered. Before this is done, however, the entire case should be reviewed to make sure that no local cause, such as calculus, tuberculosis, movable kidney with kink in the ureter, stricture of the ureter or obstruction to the outflow of urine in the bladder, has been overlooked.

## PYELITIS OF INFANCY AND CHILDHOOD

Pyelitis is not uncommon in infancy and early childhood. At the present time it is supposed to be hemic in origin, and the organism, which is the colon bacillus, is supposed to pass from the intestinal tract through the lymphatic vessels into the blood. From the blood it reaches the kidney and passes through the glomeruli and is excreted at the pelvis. The organism may pass out of the body in the urine without doing any damage, or it may set up an infection at the point of excretion and produce pyelitis.

Constipation is generally present in these cases, and there may even be occasional attacks of diarrhea.

The symptoms begin with rise of temperature and a chill which may be severe and repeated. Delirium, squinting and vomiting follow, and the child is restless and distressed. The temperature is high, 104° or 106°, and remittent in type. There is pallor and anorexia. Emaciation is slow. Local symptoms are usually slight and insignificant. Attacks of screaming, due to colic, occur, and tenderness over the kidney region is often present. Urination is increased in frequency and pain is sometimes observed.

The first indication of urinary difficulty is manifested by yellowish staining of the diapers. Upon examination of the urine it is found to be strongly acid. There is a little albumin, and pus is present in considerable amounts, some epithelial cells from the kidney pelvis, or quantities of squamous cells from the bladder, and bacteria in large numbers, which are, in the majority of cases, the colon bacillus.

### Diagnosis

The diagnosis is made by the presence of pus and bacteria in the urine. Fever and extreme distress without any other symptoms to produce them, and the occurrence of chills in a child under two years, when malaria can be excluded, are important points in diagnosis.

### Prognosis

Most of the cases recover spontaneously, although the condition sometimes terminates fatally. Rapid improvement takes place under treatment, the temperature falls and the symptoms subside in a week or ten days, although the pus and bacteria may remain in the urine for several weeks.

### Treatment

The most satisfactory treatment is that of alkalies, of which citrate of potash is the one in common use, given in 5- to 20-grain doses every three or four hours. The urine generally becomes alkaline in from one to three days, after which the temperature quickly falls and the symptoms subside. If digestion is disturbed, or diarrhea is set up by the citrate of potash, the alkalinity may be maintained by 5 to 10 grains of bicarbonate of soda or potash given every two or three hours. In cases which do not respond to the alkaline treatment urotropin should be used, and autogenous vaccines may also be of some benefit.

In spite of all treatment many cases become chronic, and these acute exacerbations alternate with long periods of quiescence, but the urine never becomes entirely free from pus cells and organisms.

## PYELITIS OF PREGNANCY

Pyelitis, which may be complicated with inflammation of the parenchyma of the kidney not infrequently develops during the early months of pregnancy. The condition appears generally about the fourth month of pregnancy and is usually confined to the right kidney, the left one being unaffected. It is supposed to be due to compression of the ureter by the gravid uterus.

### Symptoms

The disease begins with a chill and rise of temperature, with severe paroxysmal pain over the affected side and frequent and painful urination. The urine contains pus and bacteria. The fever runs an irregular course, with occasional chills and marked weakness, exhaustion and vomiting. In a few cases the disease is bilateral, and there is rapid emaciation, drowsiness, thirst, dry tongue, and other signs of uremia.

### Diagnosis

The diagnosis depends upon the finding of pus and bacteria in the urine and the location of the pain and tenderness.

### Course and Prognosis

Premature labor is very apt to occur as a consequence of pyelitis of pregnancy, when the attack occurs early in pregnancy. If the attack occurs late in the pregnancy, there is usually fever during the postpartum stage. If the pregnancy is interrupted, the child is usually ill-nourished and dies in one-third of the cases, whereas if the attack occurs late in the pregnancy, it goes on to full time and the child is usually healthy and well-nourished.

### Prophylaxis

The chief points in preventing this complication are careful asepsis in catheterization and the prevention of constipation during pregnancy. If bacteriuria exists, or there is a chronic pyelonephritis, it should be energetically treated and the patient warned of the danger of becoming pregnant.

It is in this class of cases that the ureteral catheter left in the pelvis of the kidney for several days has a most admirable field. It is done with practically no risk to the individual, relief of the retention is immediate, and the patient rapidly improves and the fever drops.

In case the woman does not improve under treatment—drainage and urinary antisepsis induction of premature labor is called for. Nephrotomy has been recommended and is said to give good results. It is particularly indicated when the pyelonephritis is unilateral. Where both kidneys are affected, premature labor should be induced in order to save the life of the woman.

## ASCENDING PYELONEPHRITIS

In pyelonephritis the parenchyma of the kidney is the seat of suppuration, as well as the pelvis. It is caused by extension of the infection from the bladder, which is unable to completely empty itself and contains residual urine. This condition is brought about by the presence of a hypertrophied prostate, a stone, or by bladder tumors which interfere with the free outflow of urine.

The question as to how the bacteria make their way from the bladder to the kidney has been discussed in the earlier section on pyelitis.

## Pathology

The pelvis of the kidney is in a state of acute or chronic inflammation, and the parenchyma of the kidney, chiefly the cortical part, is the seat of small abscesses which become conglomerated to the size of a pea and bulge on the surface. On removing the capsule many of these abscesses are broken open and discharge a greenish yellow pus. The abscesses often extend along the conducting tubules of the kidney.

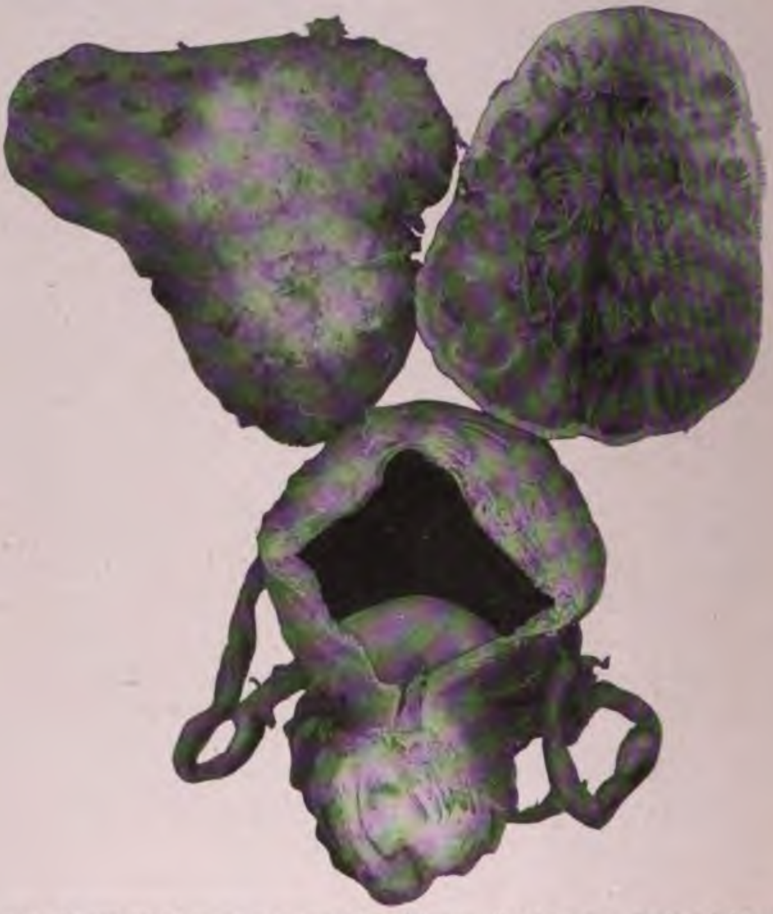

Fig. 245.—Hypertrophied prostate and ascending infection dilated ureters. Pyelonephritis and cyst of kidney. Specimen removed at autopsy. (Long Island College Hospital.)

In the early stage pyelonephritis is often unilateral, but in the later stages the disease is bilateral, but one side is usually more affected than the other.

## Symptoms and Course

During the course of some condition which gives rise to residual urine the symptoms pointing to acute suppurative pyelonephritis begin. There is usually a history of the passage of instruments, or the sudden withdrawal of a large quantity of residual urine, or an operation for the relief of hypertrophied prostate or stricture of long standing. There is a chill and rise of temperature to 102° or 104°, the patient is drowsy, complains of backache, the skin is dry and harsh, and the tongue is dry, red and glazed. Later it becomes covered with a brownish fur. Nausea and vomiting occur frequently and there is constipation. The abdomen is tympanitic. Hiccough sets in and becomes very troublesome. The urine is scanty, or there may be complete suppression. Palpation shows tenderness over one or both kidneys. The patient becomes more and more drowsy, the abdominal distention increases, vomiting occurs more frequently and hiccough is constant. The pupils react sluggishly to light. Uremic

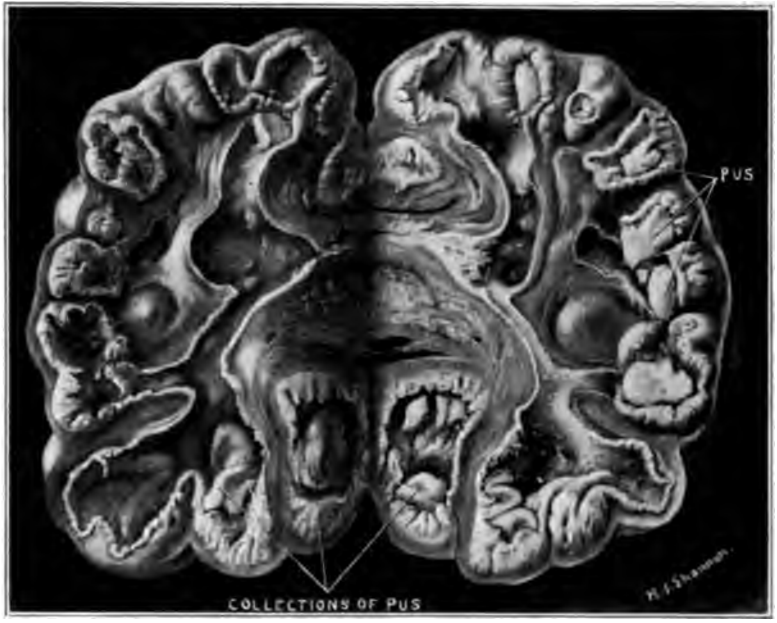

Fig. 246—Pyelonephritis from ascending infection. (Specimen from Museum of Long Island College Hospital.)

dyspnea is often observed, with Cheyne-Stokes' breathing, muttering delirium supervenes and the patient becomes comatose and dies. Occasionally, instead of being comatose, the mind remains clear and the patient is restless and anxious. The temperature is high and the urine absolutely suppressed. Later there is delirium and eventually coma.

In cases which are less severe the excretion of urine is reestablished, at first scanty, but increasing. Gas is passed by the rectum, the abdomen becomes soft, the temperature falls and the patient finally recovers.

In mild cases there is a chill, rise of temperature to 102° or 103°, reduction of the quantity of urine, headache, nausea and vomiting. There is tenderness over the kidneys and the urine becomes filled with pus. As the patient improves blood begins to appear in the urine, which comes from the kidneys. In this type severe hemorrhage may continue unless relieved by operation.

### Diagnosis

The symptoms above described occurring after the passage of an instrument or a history of interference in the person of an old man who has been suffering for a long time with conditions causing residual urine, point very conclusively to an acute pyelonephritis.

### Prognosis

In severe cases of pyelonephritis many patients, especially old men, do not recover, and of those who do recover a certain amount of permanent damage is sustained by the kidneys, which remain the seat of a chronic pyelonephritis.

### Treatment

The chief indications are to sustain the patient and to cause elimination, through the skin and bowels, of the material which the damaged kidneys can no longer excrete. Local dry cups or hot fomentations should be applied over the kidneys to relieve the renal congestion. Hot packs or the electric baker should be used to cause free sweating. The bowels should be opened by a large dose of castor oil or saline purge, and high enemata of turpentine, ox gall and magnesium sulphate should be begun to move the bowels. Every effort should be made to get water into the blood vessels by means of hypodermoclysis of glucose solution and Murphy drip and forcing water by the mouth. Tympanites may be reduced by turpentine stupes, pituitrin hypodermatically or strychnia and eserin.

Measures should be adopted at once for drainage of the bladder to keep it empty and prevent the accumulation of residual urine. To accomplish this purpose the operative procedure should be of the lightest character. A distended bladder may be drained by an inlying catheter, or it may be necessary to do a suprapubic cystotomy and drain through a large tube. For the relief of the renal congestion and sepsis nephrotomy should be performed, if it is known that only one kidney is affected. As a result of this operation the temperature falls to normal and within a few hours the dressings are flooded with urine. The temperature may remain normal and recovery be uninterrupted, or there may be a relapse and the temperature may rise again and then gradually fall. Secretion of urine, however, is reestablished and the crisis is over (Thomson Walker).

## CHRONIC PYELONEPHRITIS

After an attack of acute pyelonephritis the kidney seldom returns completely to its normal condition. It is usually the seat of chronic pyelonephritis. Although the chronic form frequently develops insidiously, as a consequence of residual urine and ascending infection, the clinical picture is known as urosepsis and is an accompaniment of many long-standing cases of chronic urinary retention, hypertrophied prostate or stricture.

### Symptoms and Course

There is a gradual and persistent loss of weight. The patient has a sallow, heavy appearance. The skin is harsh and dry, and he seldom sweats. The tongue has a very characteristic appearance—dark-brown and dry. He complains of dyspepsia, loss of appetite, occasional nausea, and constipation is marked. The mind is inactive and the patient drowsy and dull. The urine is increased in quantity and contains from 80 to 100 ounces in twenty-four hours, pale and watery, with a specific gravity of 1.008, a trace of albumin and a small deposit of pus. There are pains in the muscles of the legs and back, but palpation shows no enlargement of the kidney. On account of the polyuria there is frequent urination, especially at night. The temperature is usually subnormal, but there may be a slight evening rise. The patient may continue this way for several years and die very gradually without any appreciable symptoms, but the course is usually interrupted by exacerbations. These may come from the passage of an instrument, exposure to cold, or fatigue, or there may be no exciting cause. The attack may be severe, as described above, but usually it is of a mild character. The quantity of urine diminishes and there may be partial suppression lasting for some hours, but in favorable cases secretion of urine is restored and the patient goes on as before.

### Diagnosis

It is highly important to recognize the presence of chronic pyelonephritis before attempting any operation on the genitourinary organs, for even slight operative interference in the presence of this condition may be followed by suppression of urine and death. To recognize this condition it is necessary to have recourse to the functional kidney tests, notably the phenolsulphonephthalein or the indigo carmine. Catheterization of the ureters and examination of the separate urines is but rarely required, but no operation should be undertaken without the surgeon first having assured himself that the kidneys are capable of sustaining life after the stress of an operation.

### Treatment

As this condition in the kidney will cause death eventually if permitted to run on, it is extremely important that any obstruction which gives rise to residual urine should be removed before the damage to the kidney becomes too great.

When pyelonephritis already exists, operative interference must be regarded as a serious undertaking and should not be attempted until, through permanent drainage, the ingestion of quantities of water and urinary antiseptics, the secreting function of the kidney is restored to a point where an operation can be safely performed (see hypertrophied prostate.)

## HEMATOGENOUS PYELONEPHRITIS

In all infectious diseases bacteria enter the blood and pass out through the kidneys. In most cases they are eliminated without causing inflammation in the kidney substance, but if an obstruction to the exit of urine from the kidney exists, or the kidney is previously diseased, renal infection, which may cause an overwhelming and fatal toxemia, or a more chronic type, with or without suppuration, will follow. The origin of these localized kidney infections may be a serious infective process or some simple infection, such as a boil, a carbuncle, tonsillitis, a tooth or sinus infection, or an in-

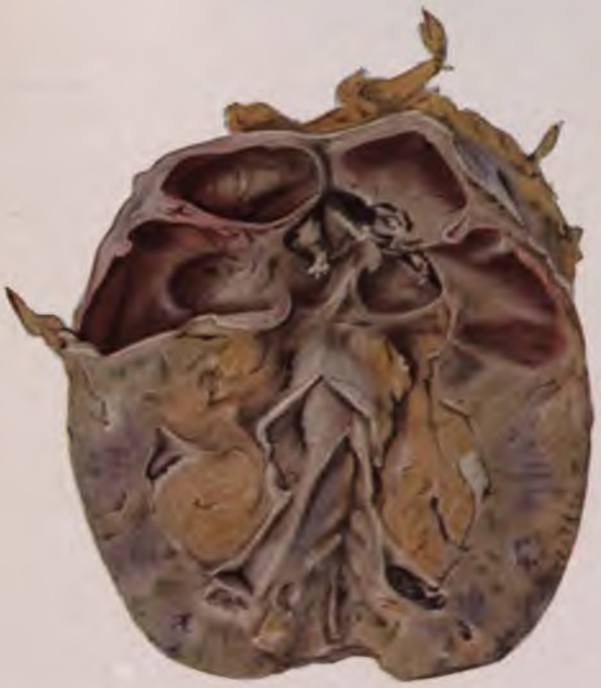

PLATE XXIII.

Abscess of the kidney. Upper pole of kidney, seat of large abscess cavity. Ascending infection from gangrenous cystitis behind impassable stricture and perineal fistulæ. Suprapubic cystotomy for drainage. Death four days later from suppression of urine. (Author's case.)

fected wound. Infarcts in the kidneys may be bilateral, but frequently they are unilateral.

The microorganisms which have been found to cause hemic infection of the kidney in the urinary tract are, in the order of their frequency, colon bacillus, tubercle bacillus, staphylococcus, streptococcus, gonococcus, proteus Hauser, typhoid bacillus, paratyphoid baillus and pneumococcus.

Hemic kidney infections are all accompanied by pyuria. Sometimes the process is localized in the pelvis of the kidney—(pyelitis) or there may be disseminated abscesses in the cortex or the medullary portion of the kidney (pyelonephritis) which is frequently noted as an accompanying pyemia, or there may be regional abscesses situated in one pole which tend to point to the pelvis of the kidney and drain through it.

Another form of hemic infection is sometimes found in children suffering from impetigo. This is a pure hemorrhagic nephritis and is probably caused by the toxins of the staphylococcus present in the lesions. A similar condition is occasionally met with in influenza, and this form is more persistent and dangerous.

## Pathology

Brewer describes the pathology as follows:

"In most instances they are found to be due to a plugging of the smaller arteries and capillary vessels with groups of organisms. These minute emboli are later surrounded by an encircling zone of round cell infiltration. Where the larger trunks are thus involved, triangu'ar infarcts are present; where the capillaries only are involved, minute abscesses are seen throughout the cortex and beneath the capsule. If the process is allowed to go on, the bacterial emboli are rarely recognized; only areas of necrosis and purulent infiltration are found. At a still later stage many of these collections of pus coalesce, forming larger parenchymatous abscesses, which may rupture through the capsule, giving rise to a perinephritis, or into the pelvis, giving the typical picture of pyelonephritis. In some of the cases the condition has been described as an acute, purulent, interstitial nephritis. In my opinion, all of these appearances are but different stages of the same process."

Three types of infection are met with in practice. The gravest of all, which, fortunately, is quite rare, is the hyperacute or fulminating type, which is so virulent that the patient dies long before any definite renal symptoms have had time to develop. A milder type is often encountered, which is not so severe as the one above mentioned, but in which the prognosis is grave, for the reason that if unrecognized and untreated it progresses insidiously and causes complete destruction of the kidney and serious interference with the functional activity of the other kidney through toxic degenerative changes. There is a still milder type which usually ends in spontaneous recovery without causing much damage to the renal parenchyma. This is of interest chiefly to the surgeon in that it accounts for the cases of so-called idiopathic pyelitis, and it also explains certain transient rises of temperature observed after surgical operations, or during convalescence from some infectious process.

### Diagnosis

Fever is always present and may be continued or remittent. The urine from the affected kidney contains leucocytes and pus; but to find the organism, cultures are frequently necessary. A severe chill usually means a high grade of infection. A blood count will show a leucocytosis up to, but usually not above 25,000. The most prominent symptom, in addition to fever, is marked tenderness at the costovertebral angle, which is always present. As the disease is generally unilateral and requires surgical interference, catheterization of the ureters should always be done. The urine from one side will be found to be clear, while on the affected side pus and renal casts, cells from the pelvis of the kidney and triple phosphates will be found. Organisms may or may not be present in the centrifuged specimen, but they can always be found on culture.

### Symptoms of the Fulminating Type

In the severe type of infection the disease is ushered in by a chill and rise of temperature to 103° or 105°. Toxemia is marked from the first, with a high fever, which suggests an acute grippe, lobar pneumonia or one of the exanthemata. Pain over the abdomen or flank, corresponding to the site of the lesion, is complained of, together with tenderness and muscular rigidity over the region of the appendix or gall bladder, which may lead the observer to conclude one of these organs to be the seat of the disease. The urine from the infected kidney is greatly diminished and is mixed with the urine from the other kidney, so that unless a very careful examination is made the slight trace of albumin, blood or pus, which is always present may be overlooked.

The one pathognomonic sign which is present in every case is a marked tenderness over the costovertebral region on the affected side.

The second, or intermediary, type may easily be mistaken on account of its stimulating appendicitis, cholecystitis, or abscess of the liver.

If the condition is unrecognized and unrelieved by appropriate treatment, it goes on to the formation of a renal abscess, perinephritic abscess, or pyonephrosis.

In the milder type the lesions are of the same general character as in the severe type, but fewer and more scattered, and the amount of renal tissue involved is less.

In the mild type the symptoms are slight, and fever and tenderness over the costovertebral region on one side on pressure may be the only symptoms. This type is of interest inasmuch as it may account for certain irregular rises of temperature occurring during convalescence from some surgical or infectious disease without any appreciable cause. Such cases have been described under the term of *idiopathic pyelitis.*

## Treatment

In the fulminating type Brewer believes that an early nephrectomy offers the only chance of life to the patient. From his personal experience, out of sixteen patients who were subjected to other forms of treatment, six died; ten were treated by early nephrectomy and all recovered. In the second group, or the intermediary type, he believes that early stripping of the capsule from the organ when the lesions are small, or combined with the opening and draining of cortical abscesses or areas of necrosis, when present, constitutes the best treatment, and in the great majority of instances will save the kidney. In certain instances, where the treatment has been delayed too long, the suppurative process continues and a secondary nephrectomy may be necessary. In these cases the success of the treatment depends upon the early recognition of the condition and prompt operation. This relieves the acute hyperemia, particularly in the cortical zone, in which the lesions are largely situated, and favors the early inauguration of the process of repair.

The third, or mildest, type has a tendency to spontaneous recovery and it is only necessary to keep the patient in bed, allowing him to drink freely of water and giving urotropin internally.

# CHAPTER XXXII

# HYDRONEPHROSIS

When, from some mechanical obstacle in the ureter, the urine is prevented from flowing out from the pelvis of the kidney, retention of the nonpurulent urine occurs, and the pelvis and calices of the kidney become enormously dilated. Atrophy of its secreting substance takes place, with the formation of distinct cysts, which may attain to a very great size.

## Etiology

**Congenital Causes.**—The ureter may be entirely absent, or obliterated in some part, or the obstruction may develop after birth, on account of a twisting of the ureter or the formation of a valve-like fold, causing partial or complete closure of its lumen.

If an abnormal insertion of the ureter exists either at its origin from the pelvis of the kidney or at its entrance into the bladder, the angle of the insertion of the ureter may be so acute that it is compressed and its lumen closed when the patient is in the standing position.

**Acquired causes** operate either by compressing the ureter or obstructing the outflow of urine and causing it to be dammed back upon the kidneys. Tumors of the ovary and ureters, prostatic hypertrophy, and atony of the bladder will produce this effect at times.

A very frequent cause of hydronephrosis is a renal calculus acting as a ball-valve as it lies in the pelvis of the kidney at the mouth of the ureter, or if it enters the ureter and becomes fixed at any point in its course.

From any of these causes the obstruction may be *complete*, so that no urine can pass through the ureter, or it may be *incomplete*, and a portion of the urine passes through into the bladder.

**Intermittent hydronephrosis** occurs chiefly as a result of a movable kidney, as changes in the position of the kidney cause bends and twists in the ureter, and in consequence stagnation of the urine in the pelvis of the kidney, and ultimately dilatation with cystic formation.

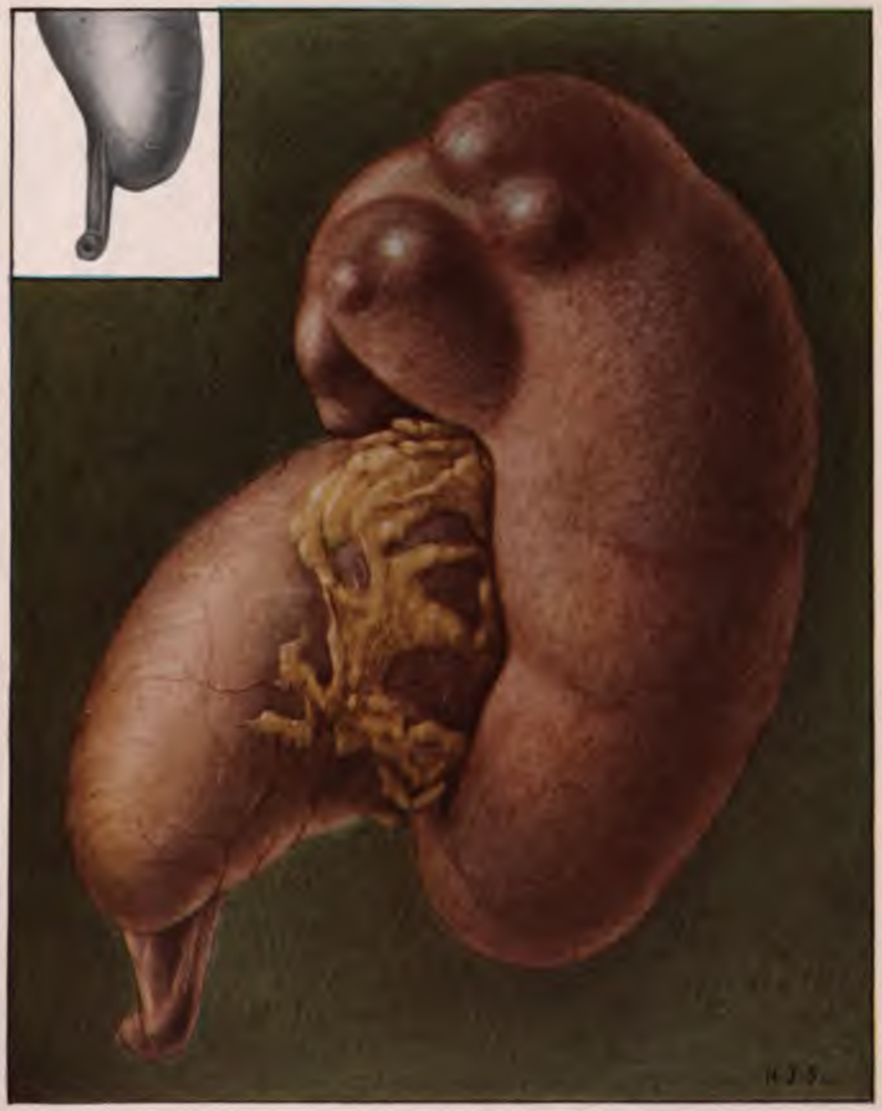

PLATE XXIV.

Hydronephrosis of kidney and pelvis from twist in ureter. Specimen from Museum of Long Island College Hospital.

The sac becomes completely filled, and then, if the obstruction is temporarily removed, it is emptied, and a large discharge of urine occurs into the bladder, and the hydronephrotic tumor disappears.

The obstruction in the ureter returns and the sac gradually refills, and after a varying time is again emptied.

The process of accumulation and discharge is repeated indefinitely unless the ureter becomes completely and permanently blocked, which usually occurs in the course of time.

## Symptoms

The symptoms of hydronephrosis are vague and indefinite, and consist in the formation of a fluctuating tumor in the flank, which may be large enough to fill the entire abdominal cavity, together with frequent urination, and a diminution in the quantity of urine passed. The symptoms caused by *intermittent hydronephrosis* are generally occasioned by a movable kidney, in which condition the ureter is obstructed by being bent at an angle.

The attacks are accompanied by violent pain and diminution in the quantity of urine, and may easily be mistaken for an attack of renal calculus. When the kidney falls back into its normal place the ureter is straightened out, the pain ceases suddenly, and large quantities of urine are discharged.

## Prognosis

Hydronephrosis may remain stationary for years, but the pressure of the accumulated fluid leads, in time, to an atrophy of more or less of the parenchyma of the kidney-substance, although the secreting structures are never entirely destroyed.

The affection is often complicated by infection with pyogenic organisms, and the case becomes converted into one of pyonephrosis, with its attendant dangers.

Large sacs have been known to rupture into the abdominal cavity and cause peritonitis, and in a few cases of intermittent hydronephrosis spontaneous cure has occurred.

## Diagnosis

The diagnosis presents many difficulties, although a history of the sudden disappearance of a tumor coincident with the discharge of large quantities of urine is eminently suggestive of intermittent hydronephrosis.

An ovarian tumor is very liable to be mistaken for hydronephrosis. The distinguishing point is the situation of the kidney tumor in the flank, with the colon or small intestine in front of it.

Exploratory puncture of the tumor may throw some light upon the case, by furnishing a fluid containing urea or uric acid, but those ingredients of urine often disappear by absorption, and liquid resembles that contained in any simple cyst. Catheterization of the ureters settles the question of diagnosis, by demonstrating if urine issues from one or both ureters and if it is clear or purulent. A large quantity of urine may be drawn with the ureteral catheter from a distended hydronephrotic sac and it usually issues in a strong stream from the mouth of the catheter.

A radiogram will often show the outline of a distended kidney, but by means of pyelography a clear picture may be obtained of the distended pelvis of the kidney.

Pyelography is also useful in the differential diagnosis between hydronephrosis and other abdominal tumors by demonstrating the position of the renal pelvis and its relation to the tumor.

## Treatment

It is seldom possible to remove the obstruction in the ureter and reestablish the flow of urine through it, except when due to movable kidney or pressure upon the ureter from an abdominal growth, and the various attempts to do away with the obstruction by massage and ureteral catheterization, etc., have been rarely crowned with success.

In double hydronephrosis incision of both saccular kidneys by lumbar nephrotomy, with an interval between the two operations, and the establishment of a permanent fistula, although causing great inconvenience to the patient, afford the only hope of arresting the destruction of the secreting portions of the kidney and saving the life of the patient.

In unilateral hydronephrosis incision and drainage through the loin (nephrotomy) is the operation of choice, and later on, if the annoyance of the fistula becomes unbearable and the other kidney is found to be healthy, nephrectomy may be done upon the diseased kidney and the fistula allowed to close.

Before nephrectomy is undertaken it may be desirable to endeavor to remove the obstruction in the ureter by catheterization.

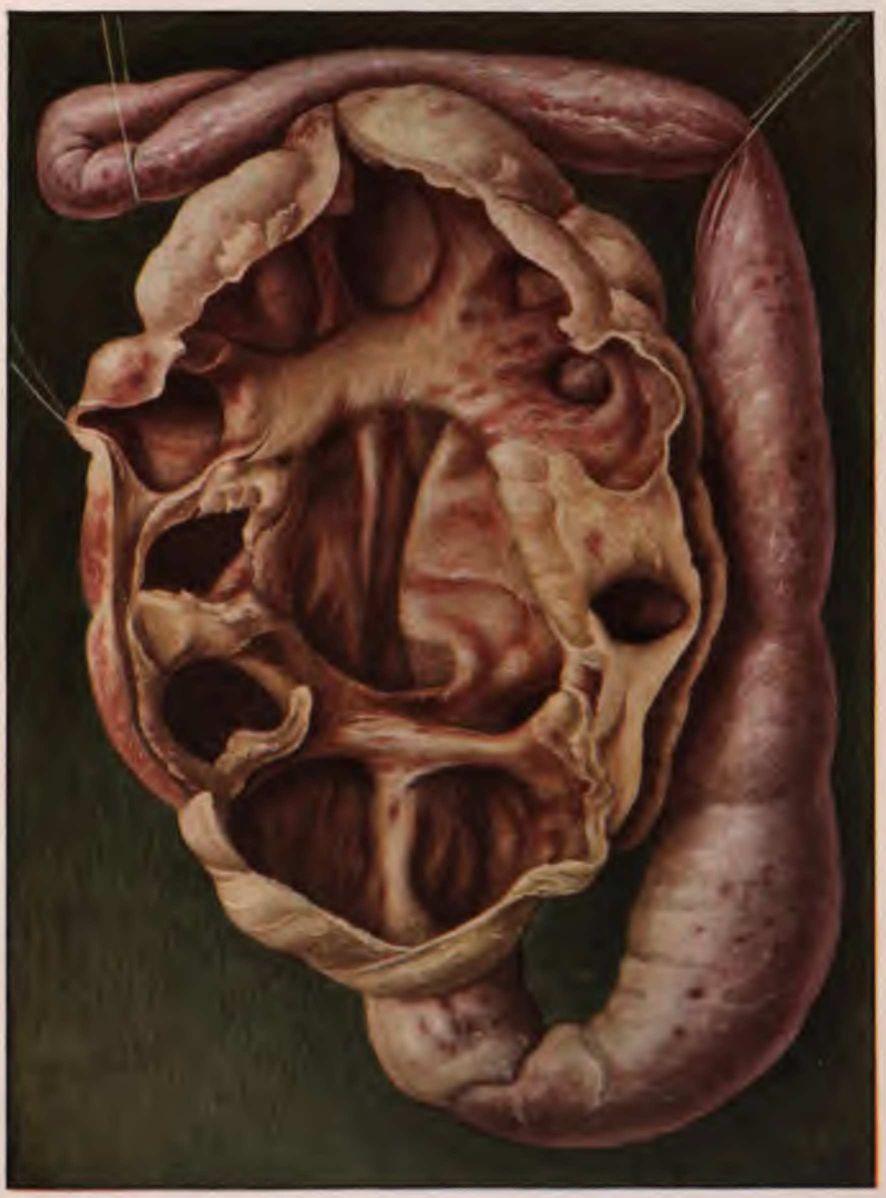

PLATE XXV.

Hydronephrosis and dilated ureter. Specimen from Museum of Long Island College Hospital.

or the advisability of transplantation of the ureters may be considered.

The retention of a permanent catheter in the pelvis of the kidney as described in the treatment of pyelitis may be tried for a time before proceeding to the more serious surgical operations.

The operation of aspiration, or **lumbar puncture,** although formerly practiced, is seldom employed today, except in the cases where an operation is strongly indicated, but for some reason nephrotomy can not be performed at the time.

In certain cases of intermittent hydronephrosis a permanent cure is said to have followed the operation of lumbar puncture.

When hydronephrosis depends upon a movable or floating kidney nephropexy is indicated, and when the kidney is fixed in place the accumulation of urine and overdistention of the pelvis of the kidney may cease.

## PYONEPHROSIS

Pyonephrosis is always secondary to some other condition, and it may develop in two ways: (*a*) as a result of infection with microorganisms of the watery contents of the kidney in *hydronephrosis,* or (*b*) in consequence of the occlusion of the ureter in a case of *pyelonephritis.* In either instance the pelvis of the kidney becomes rapidly distended, and the kidney itself is soon destroyed by the formation of multiple abscesses in its parenchyma. The entire kidney becomes converted into a large sac surrounded by its capsule and filled with urine and pus.

In course of time the tumor becomes firmly attached to the abdominal wall by adhesions, and suppuration occurs outside the kidney, forming perinephritic abscess.

The ureters become thickened in their walls, and often converted into an impervious string of tissue, or, on the other hand, the ureters may be dilated.

### Symptoms

On account of the different ways in which pyonephrosis begins, the clinical picture is a varying one.

One symptom which is always present as long as the ureter remains patulous is *pus in the urine.* This, as a rule, is constant, and not remittent, unless the ureter becomes occluded, when constitutional symptoms occur. Under such circumstances colicky pain in the lumbar region is felt, the pus disappears from the urine, and the quantity of urine is diminished; septic fever, with chills and well-marked remissions, also occurs. If the ureter becomes patulous again, pus reappears in the urine and the temperature falls to normal.

Disappearance of pus from the urine, however, does not invariably imply that the ureter is occluded. For it sometimes happens that the abscess cavity in the kidney empties itself entirely of pus, and the urine remains clear for several days, until the pus reaccumulates in the kidney and again begins to flow out through the ureter.

In cases of pyonephrosis a *tumor* is present, and is felt as a rounded, tender, obscurely fluctuating mass located under the free border of the ribs. The tumor can usually be felt, unless it is high up under the ribs and the pus has been temporarily drained out through the ureter.

*Pain* is a somewhat inconstant symptom; often it is not present or may be elicited by deep pressure.

The general health of the individual always suffers in consequence of the drain of the suppuration and the attacks of septic fever, and the patient becomes emaciated and anemic.

## Diagnosis

The first point to determine is, whether one kidney alone is affected or whether both are diseased.

Sometimes a cystoscopic examination of the bladder shows a stream of purulent urine coming from one or both ureters.

If this is not adequate to establish the diagnosis, the ureter on the suspected side may be catheterized and the urine drawn from the bladder with a catheter for examination for comparison, or both ureters may be catheterized and the right and left urines examined.

In this way we can ascertain if the second kidney is healthy and how it is working. To decide the question as to whether it is at all diseased or if bady crippled, a chemical and microscopic examination of the separate urine is necessary.

A radiogram will usually show the outlines of an enlarged kidney, and pyelography will demonstrate the large cavities gutted out in the parenchyma of the organ.

## Prognosis

The prognosis depends on how rapidly the suppuration advances, and, furthermore, if one kidney is affected, or both.

Unilateral pyonephrosis offers a better prognosis, and can exist for years without a bad effect upon the general health. In course of time, however, the long-continued absorption of toxins into the blood sets up a toxic nephritis upon the other side.

In exceptional instances spontaneous healing may occur, for the entire kidney may suppurate and be destroyed, becoming converted into a mass of connective tissue. This outcome is so extremely rare that it can not be hoped for.

More frequently, however, when the suppuration is allowed to advance without operative interference, the surrounding connective tissue is attacked and a diffuse perinephritis and paranephritis is set up.

### Treatment

The treatment depends upon the character of the process and whether one or both kidneys are affected.

Internal treatment is of no use, since it is impossible to make the suppurating kidney-sac aseptic by drugs given by the mouth.

It is necessary to attack the foci of suppuration locally, either by irrigation of the pelvis of the kidney through a ureteral catheter or by means of incision or extirpation of the kidney.

A few cases not dependent on calculus or tuberculosis, where the pyonephritic sac was small in size and a good deal of kidney parenchyma remained are reported as cured by permanent drainage of the pelvis of the kidney by means of a ureteral catheter and pelvic lavage with nitrate-of-silver solution.

In a case of pyonephrosis, however, in which the kidney-substance is riddled with abscesses, which may not communicate with the pelvis of the kidney, catheter drainage and irrigation are useless.

After the pelvis of the kidney has been drained and washed out through the ureteral catheter for a time, and the patient's condition does not show a decided improvement, no further time should be lost, but operative measures should be proceeded with at once.

If the second kidney has been investigated and found to be healthy, nephrectomy is the operation to be performed and the kidney removed by subcapsular enucleation. In long-standing cases the capsule is converted into a thick fibrofatty mass, from which the kidney can be shelled out with comparative ease, while the removal of kidney and capsule together is technically very difficult, and accompanied by the danger of tearing into the peritoneal cavity or colon.

If the kidney is much distended with pus, it is often necessary to reduce its size by tapping it with a trocar, removing a large part of its contents, so that sufficient exposure of the pedicle may be attained in order to tie it.

If the second kidney is badly diseased with its function impaired, nephrectomy is contraindicated, as it is a severe operation for an individual in broken-down health. Nephrotomy also fails to afford much benefit, as the patient is always annoyed with a troublesome fistula, which is continually leaking. For these reasons many surgeons are of the opinion that cases of double pyonephrosis are inoperable.

# CHAPTER XXXIII

## RENAL CALCULUS

The formation of stone in the kidneys is of frequent occurrence, and often precedes vesical calculus. Stones composed of uric acid crystals are most common, and the next in point of frequency are oxalic stones. Phosphatic calculi are rare, and are caused by the alkaline decomposition of urine as a result of pyogenic infection.

The stones are generally found in the pelvis of the kidney, and may be single or may be in hundreds, or they may be imbedded in the parenchyma.

### Etiology

The causation of kidney stone is generally the gouty diathesis (see Vesical Calculus). A few crystals are agglomerated in one of the renal tubules upon some substance, such as a blood clot, coagulum of pus, or roughness of the wall, which serves as a nucleus. The agglomeration is washed out into the pelvis of the kidney, where it becomes the nucleus of a calculus.

The stone, if single, may be adherent to the walls of the pelvis of the kidney, or it may be movable and act as a ball valve, closing the mouth of the ureter. The urine is dammed back, in consequence causing *hydronephrosis.*

Infection with microorganisms usually occurs, and suppurative pyelonephritis follows.

A stone in the kidney continually increases in size and in time the kidney itself becomes completely disorganized through the suppurative pyelonephritis it occasions.

Not infrequently as the calculus becomes large it induces a necrosis of the wall of the kidney with the formation of a perinephritic abscess.

Even in the cases where but little discomfort is felt, the patient is always exposed to these dangers or that of an obstruction of the ureter with resulting hydronephrosis or suppression of urine.

### Symptoms

A stone may be present in the kidney for years without causing much discomfort, as the symptoms are due not to the mere presence of a foreign body, but to obstruction. They are as follows:

(*a*) Attacks of renal colic.
(*b*) Pain.
(*c*) Hematuria.
(*d*) Pyuria.
(*e*) Disturbances of the urinary function.
(*f*) Gastrointestinal disturbances.
(*g*) Passage of fragments of calculi.

**Attacks of renal colic** are strongly indicative of kidney stone, although typical paroxysms may be induced by other causes, and not infrequently renal stone has been diagnosed and operated for and its absence demonstrated on cutting open the kidney.

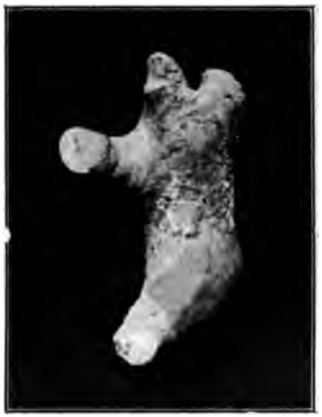

Fig. 247.—Renal calculus. Pyelotomy. (Author's case.)

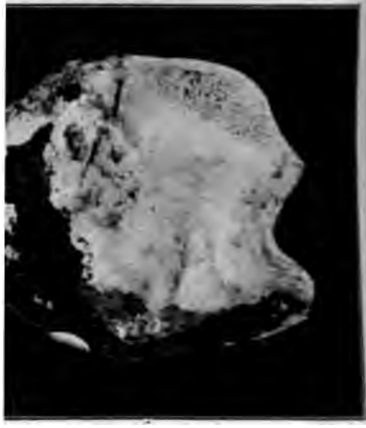

Fig. 248.—Renal calculus. Nephrectomy. (Author's case.)

Renal colic is caused by the stone being forced out of the pelvis of the kidney and entering the ureter. An attack comes on abruptly, and is characterized by agonizing pain, which is felt in the loin, and radiates down into the testicle and along the inner side of the thigh.

The pain may also radiate through the abdomen and chest, and be very intense in the back. In severe attacks nausea and vomiting occur, the pulse is feeble, the skin is covered with a cold sweat, and the patient is in a state of collapse.

In lighter cases urination is frequent and the urine discolored with blood, or the patient may be unable to empty his bladder.

In rare cases the secretion of urine may be entirely suppressed either from (*a*) reflex disturbance of the secreting kidney; (*b*) ex-

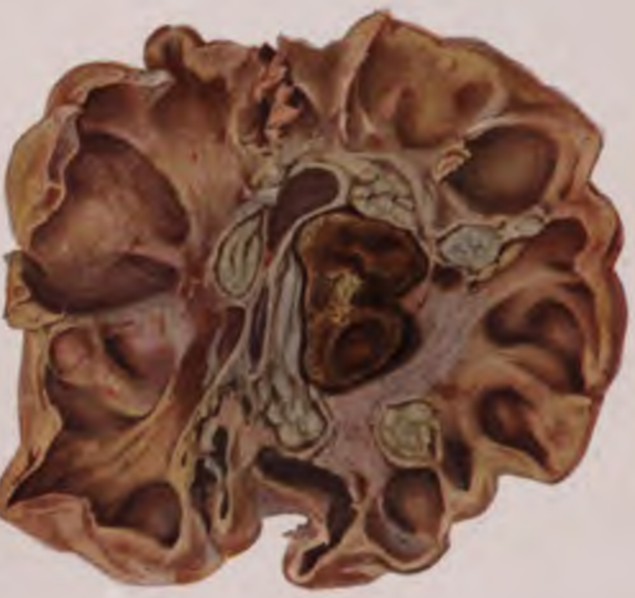

PLATE XXVI.

Renal calculus. Kidney parenchyma entirely destroyed and organ converted into a pyonephrotic sac. Nephrectomy. (Author's case.)

tensive disease of the other kidney, whose ureter is not blocked; (*c*) where only one kidney exists in the body.

In these cases uremic symptoms develop after a week, and death takes place within a fortnight after the obstruction.

The pain and disturbance of ureteral colic may last for a few minutes or for a number of hours, and usually cease abruptly as the stone either drops back into the pelvis of the kidney or makes its escape from the lower end of the ureter and enters the bladder.

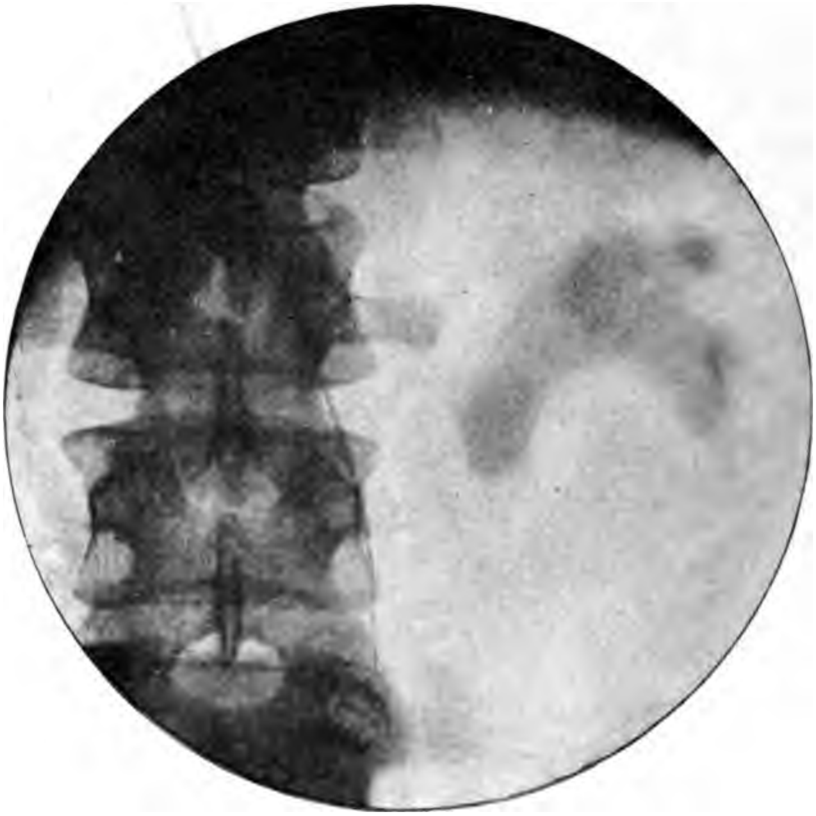

Fig. 249.—Radiogram of renal calculus. (Courtesy of Dr. Eastmond.)

The stone occasionally becomes permanently fixed in the ureter, in which case, after some time, the walls give way slightly around it, permitting a portion of the urine to pass by; but the urine is dammed back upon the kidney, and *hydronephrosis* is developed.

**Pain** is felt over the affected kidney, which is increased by motion, jarring, and pressure over the side.

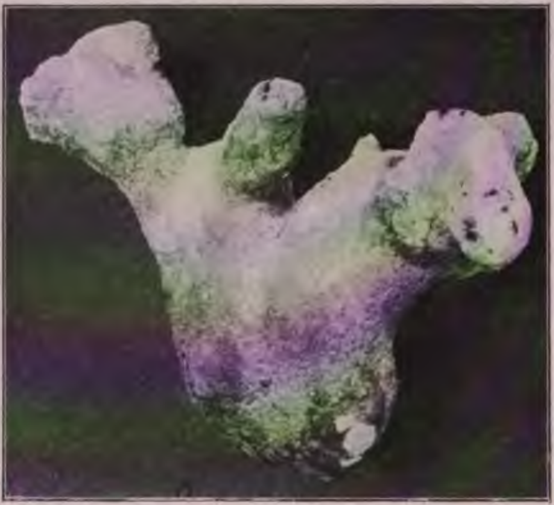

Fig. 250.—Renal calculus. Nephrotomy with subsequent nephrectomy. (Author's case.)

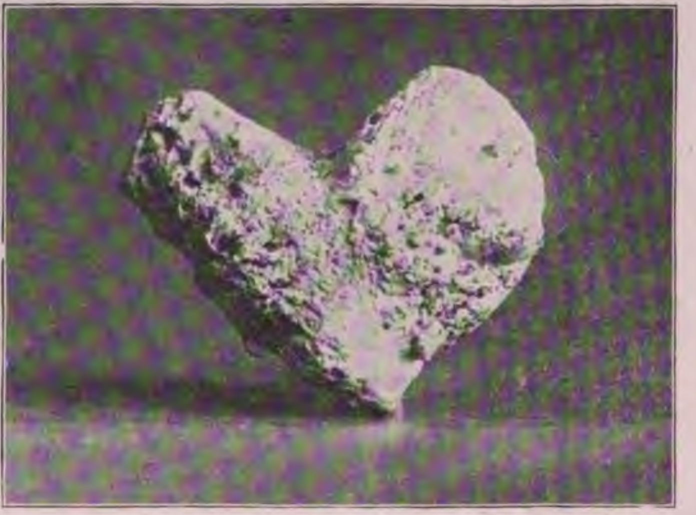

Fig. 251.—Renal calculus removed by nephrolithotomy. (Author's case.)

The sensation is that of a feeling of weight, rather than of acute pain, but the patient is liable to have paroxysms of acute pain, which often occur at night, when he is at rest in bed.

The pain radiates along the ureter and into the testicle, and often causes contraction of the cremaster muscle, with drawing up of the testicle on the affected side. The pain may be referred to the healthy kidney or to the bladder, thigh, or calf of the leg.

**Hematuria** occurs most frequently when the stone is passing through the ureter, but may appear when the stone is in the pelvis of the kidney.

The bleeding may come on in a slight amount, giving the urine a smoky color, or the urine may be free for days until, after some sudden exertion or a prolonged ride, a considerable amount of bleeding takes place.

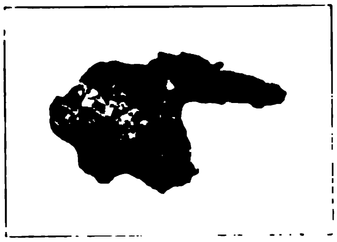

Fig. 252.—Renal calculus removed by nephrolithotomy. Supernumerary veins of kidney ruptured, necessitating nephrectomy. (Author's case, Long Island College Hospital.)

Fig. 253.—Stone removed from kidney by pyelotomy.

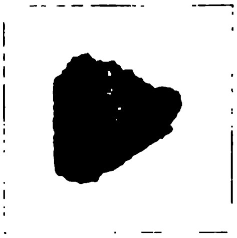

Fig. 254. Renal calculus removed by pyelotomy. (Author's case, Long Island College Hospital.)

**Pyuria** occurs only after suppurative disease of the kidney has occurred, but this is usually established in time.

**Disturbances of Urinary Function.**—The irritative effect of stone in the kidney causes it to secrete an excessive quantity of urine by day when the patient is moving about, but at night, when he is quiet in bed, the secretion of urine is normal in quantity.

As a result of blocking the ureter with a stone, the urine may be diminished in quantity or entirely suppressed for a time. If it persists after the attack is past, it is clear either that the ureter of the functioning kidney is blocked with a stone and that the other kidney is so much diseased that it is not capable of secreting, or else that there is only one kidney present.

Occasionally the obstruction develops insidiously, without attracting attention until symptoms of uremia set it.

**Gastrointestinal disturbances** may be reflex in origin or may result from imperfect elimination by the diseased kidneys. Dyspepsia, vomiting, and epigastric tenderness may easily cause the condition of the kidneys to be overlooked.

**Passage of fragments of calculi** is very often absent, or the fragments are overlooked by the patient, but when present is of great value in indicating the presence of kidney stone, even though colic was not caused by the passage of the fragments through the ureters.

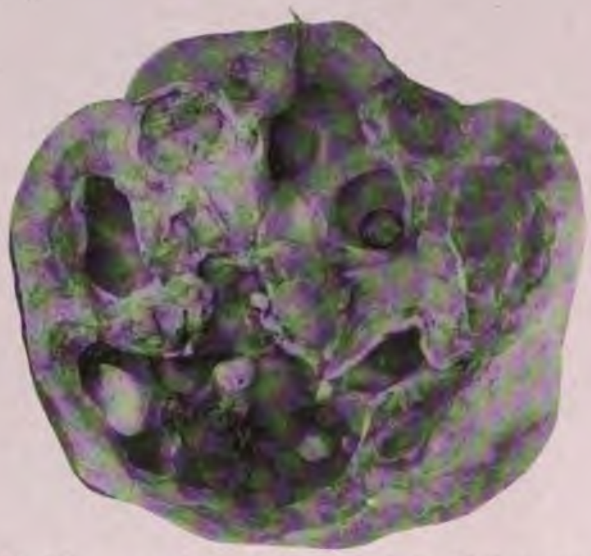

Fig. 255.—Kidney removed for multiple renal calculi. (Author's case, Long Island College Hospital.)

## Diagnosis

A positive diagnosis of renal calculus is impossible to make without the radiogram and ureteral catheterization, and many cases are on record in which the kidney was incised for the purpose of removing a stone when none was present.

The most characteristic symptoms of kidney stone are passage of gravel or fragments of stone, attacks of typical renal colic, hematuria, and, in time, pyelitis.

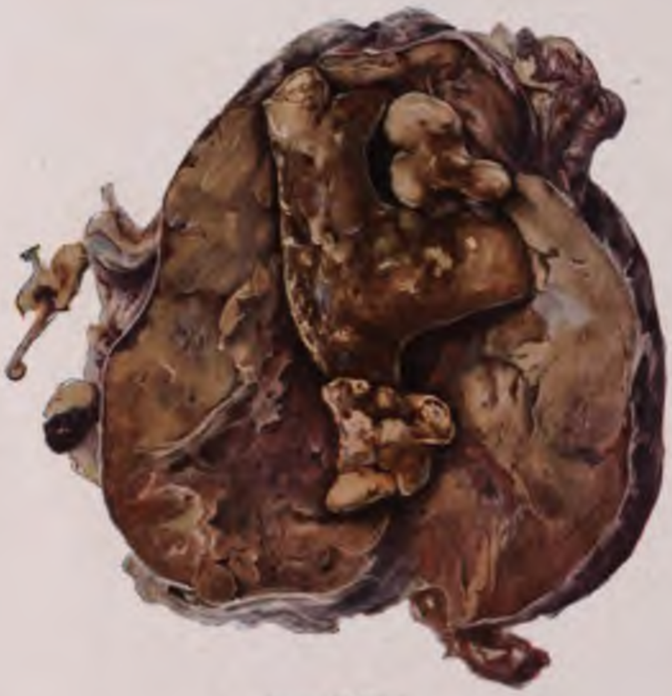

PLATE XXVII.

Renal calculus. Secreting parenchyma destroyed by formation of connective tissue. Nephrectomy. (Author's case.)

Hematuria and pain are often caused by tuberculous or malignant disease of the kidney, and oxaluria and strongly acid urine occasion a dull ache over the kidneys or even paroxysms of pain, which are sometimes accompanied by hematuria.

Spinal caries of the lower dorsal vertebræ and locomotor ataxia may stimulate the pain of kidney-stone.

During an attack of renal colic it may be impossible to distinguish between the passage of a gallstone or of a stone through the ureter.

Before attempting any operation it is, of course, essential to determine if both kidneys are affected or if the disease is confined to one side only. The location of the pain and tenderness on palpation throws some light as to which side the disease is located upon, but the question may be settled positively by catheterization of the ureters and a radiogram.

The x-ray has been of great use since its introduction in diagnosing cases of kidney stone, and is now regarded as one of the indispensable diagnostic aids.

The apparatus and technic of radiography have been so perfected that it is possible to make skiagraphs of moderate-sized objects upon which a diagnosis can be made regardless of signs and symptoms, but in the preliminary examination it is not enough for the surgeon to depend upon the radiogram alone. He must also know the functional capacity of the other kidney, and this can only be learned by ureteral catheterization and examination of the separate urines.

## Prognosis

A stone may remain in the pelvis of the kidney for years without causing any serious disability, and only at times induce transient pain or hematuria, but the patient is continually exposed to the danger of obstruction of the ureter and suppuration of the kidneys from pyogenic infection.

If a fragment of stone passes into the ureter, it usually escapes into the bladder, but, if it becomes impacted in the ureter, disorganization of the kidney ultimately takes place, and the same is true if suppuration of the kidney occurs.

## Treatment

Attacks of renal colic are sometimes cut short by a prolonged hot bath and a full dose of morphine hypodermatically.

In giving opium it is necessary to exercise caution and not give too large a quantity, for as soon as the stone is released and slips out of the ureter, the pain ceases, and the patient may be overcome by the effect of the drug.

In cases which do not respond to morphine it may be necessary to secure relaxation by means of anesthesia with chloroform or ether.

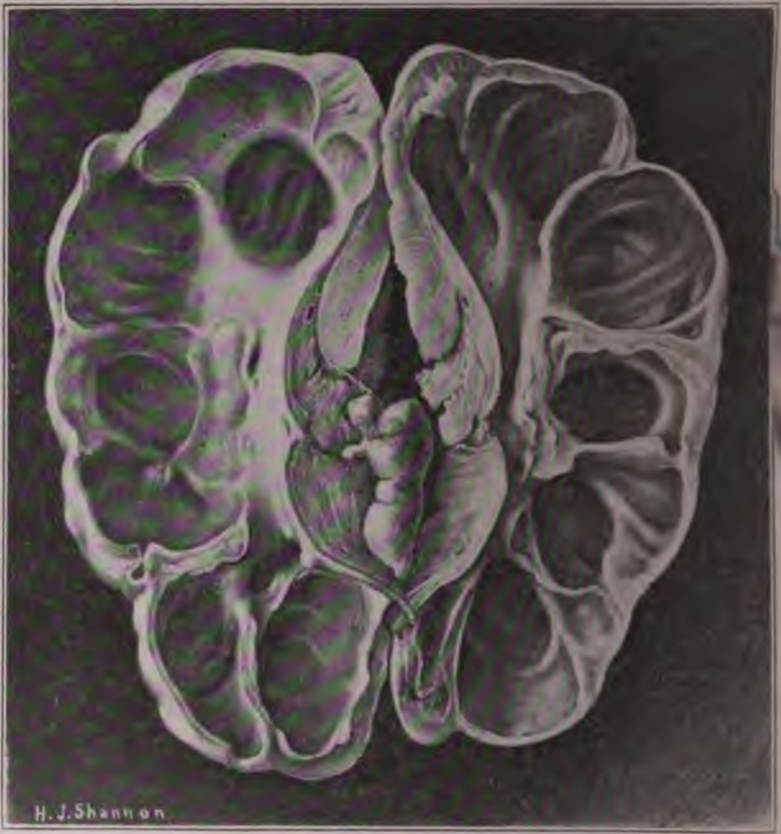

Fig. 256.—Pyonephrosis and renal calculus. (Specimen from Museum of Long Island College Hospital.)

In the intervals of the attacks the general diathetic condition of the patient upon which the formation of stone depends should receive proper attention (see Treatment of Stone in the Bladder).

But little success has been attained by efforts at dissolving stones. Piperazin, in 5-grain doses taken in a pint of water three times a day, is thought to have some effect in dissolving the albu-

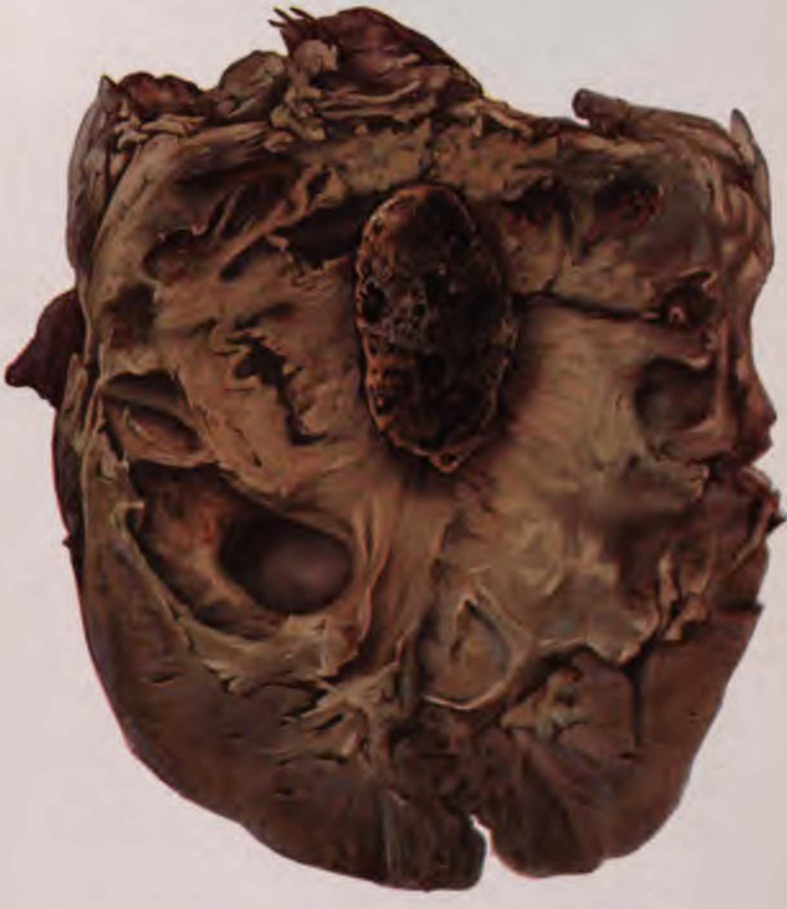

PLATE XXVIII.

Renal calculus and pyelitis. Kidney almost completely disorganized. Nephrectomy. (Author's case.)

minous framework of a uric acid calculus, and phosphatic stones may perhaps be softened and broken down by urotropin.

It is said that a small stone may sometimes be assisted in passing through the ureter by administering glycerin, ℥iss by the mouth, three times a day.

The most important point in the treatment in addition to regulation of the diet and general hygiene, is to keep the urine abundant and of low specific gravity by drinking freely of pure spring or distilled water.

As every stone in the kidney causes ultimate destruction of the kidney in time and may induce suppression of urine by blocking the ureter or occasion a perinephritic abscess, its immediate removal by surgical operation is demanded as soon as the diagnosis is made.

If the operative removal of the stone is done before it has existed long enough to cause much damage to the kidney, the risk to life is very slight.

Watson collected 135 cases uncomplicated by sepsis or dilatation with 3 deaths; Rovsing 115 cases nephrolithotomy in noninfected cases with 7 deaths.

In cases in which infection is present and the kidney notably affected and disorganized, the death rate is high. Schmieden collected 211 cases with 43 deaths, and Keister states 251 cases operated with 50 deaths.

Through a lumbar incision the kidney can be exposed and cut into, on its outer convex side, sufficiently to admit the finger into its pelvis, which can be thoroughly searched and the stone found and removed.

Small stones can be removed by making an incision into the ureter as it issues from the kidney, pyelolithotomy in this way sparing the more extensive damage to the secreting tubules.

If the kidney has been the seat of prolonged suppuration and has undergone a very considerable amount of destruction, it is better to remove the damaged kidney entirely, provided it has been previously ascertained that the kidney on the opposite side is sound.

# CHAPTER XXXIV

## TUBERCULOSIS OF THE KIDNEY

Renal tuberculosis was formerly thought to originate invariably in the bladder and prostate, and to ascend through the ureters to the kidney; but it is now known that the tubercle bacilli are carried through the blood circulation and deposited in the kidney, thus causing a *primary infection* of the organ.

The bladder is frequently affected secondarily, by the bacilli passing with the urine from the kidney, or it may remain entirely unaffected.

An ascending infection of the kidney from a tuberculous bladder is an occurrence of great rarity.

Tuberculosis of the kidneys is a disease of young persons, occurring almost always between the ages of 20 and 30. In point of frequency men and women are similarly affected. In the great majority of cases the tuberculosis is apparently a primary infection of one kidney, and it is not possible to demonstrate active foci of tuberculosis in the body, although they may exist latent and unsuspected. This is a most important clinical fact, for upon it is based the modern treatment of tuberculosis of the kidney, as an early nephrectomy removes the tangible focus of tuberculosis from the body. After the kidney is removed, further development of the infection does not occur, and the patient's life is saved.

The kidney may be infected in two ways, either from a focus of tuberculosis, from which the bacilli are carried through the blood in the form of emboli and deposited in the capillaries of the kidney, or the bacilli are taken into the blood through the stomach or lungs and are carried to the kidney, developing foci of tuberculosis at the point of weakened resistance. This is the so-called *hematogenous infection* and is by far the most common mode. One kidney alone is attacked at first, and after several months the other becomes infected. This is shown by postmortem examinations, which demonstrate that after long-standing tuberculous disease both kidneys are affected. The fact that in the early months only one kidney is infected is proved by catheterizing the ureters and examining the urine from the right and left sides. The necessity

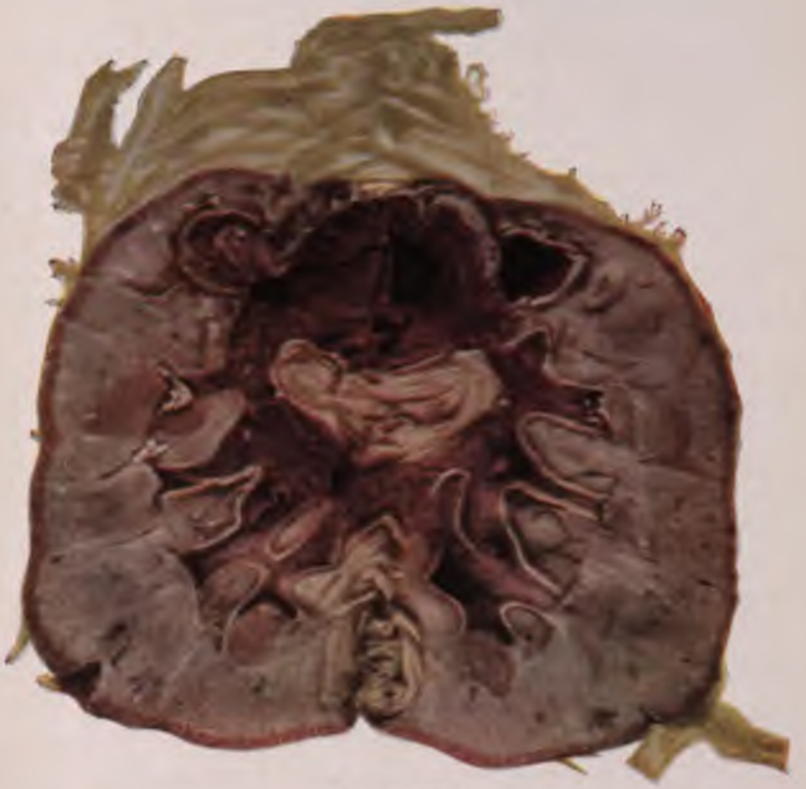

PLATE XXIX.

Tuberculosis of kidney. A large abscess cavity at one pole and a good deal of parenchyma undestroyed and secreting. Nephrectomy. (Author's case.)

of early diagnosis is an important suggestion for treatment, for if the diseased kidney is promptly removed before infection of the other one nephrectomy prevents further trouble and is a life-saving operation.

This applies only to those cases of what might properly be called primary tuberculosis of the kidney in which foci can not be demonstrated elsewhere in the body.

In a few cases the tuberculosis apparently begins in the prostate or epididymis and both kidneys are affected secondarily by an extension of the process, either by metastasis through the lymph vessels and periureteral tissues, through the blood current, or by a direct ascent of the bacilli through the ureters to the pelvis of the kidney. The extension of the process is slow, and the kidneys are only attacked shortly before the death of the patient, which occurs from ulcerative perforations of the bladder and urethra into the rectum.

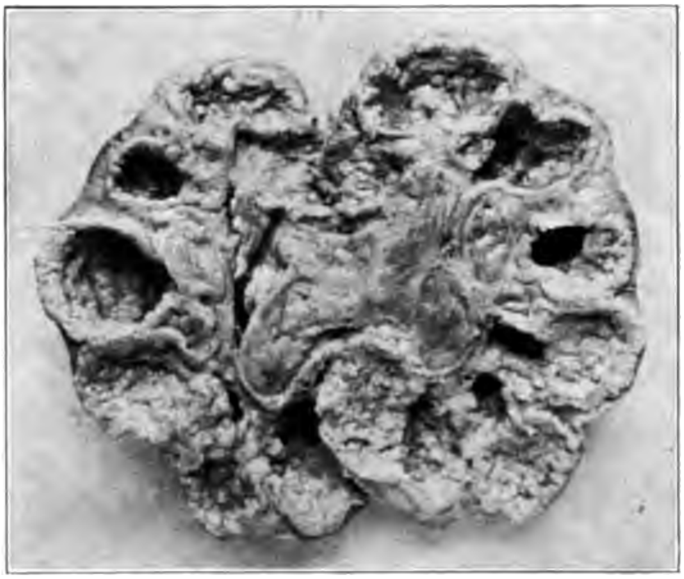

Fig. 257.—Tuberculous Pyonephrosis. Nephrectomy. (Author's case, Long Island College Hospital.)

It was formerly supposed that the kidneys were usually infected by a direct ascent of the tubercle bacilli from the bladder through the ureters, and, while this is the mode of infection in pyelitis, occasioned by stagnating urine in a bladder which can not empty itself, as a result of stone, stricture, or enlarged prostate, it is known today that an ascending infection of the kidneys is a rare event in tuberculosis. An exception to this general rule takes place when the tuberculous process begins in the vas deferens or seminal vesicles. In these cases the process extends to the ureter, causing a stricture with stagnating urine. At night, with the patient in a recumbent position, the bacilli readily make their way through the ureter into the pelvis of the kidney and cause pyelitis.

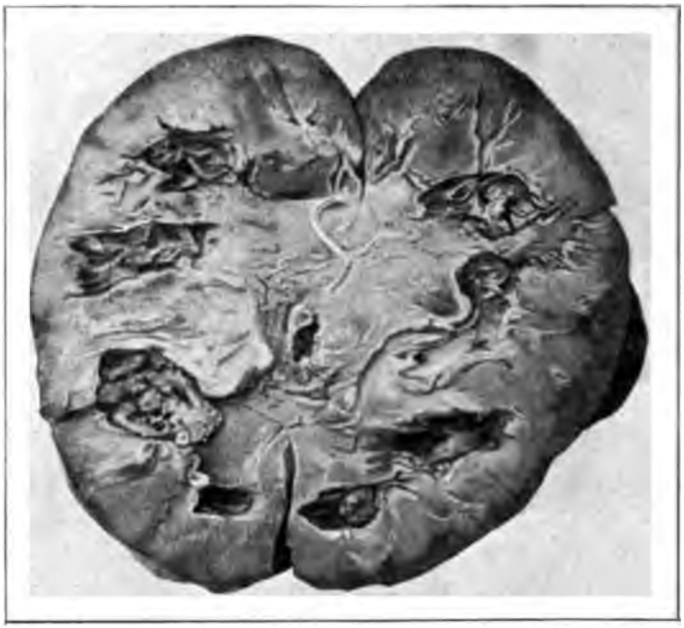

Fig. 258.—Tuberculosis of kidney. Isolated foci in parenchyma which are beginning to break down. Nephrectomy. Recovery. (Author's case.)

## Pathologic Anatomy

The pathologic anatomy of tuberculosis of the kidney consists in the deposit of isolated foci of tuberculosis in its parenchyma, which become cheesy, break down, and the pus is discharged into the pelvis of the kidney. After a time the foci coalesce and form large cavities, often communicating and filled with pus, or large abscesses may form at one pole and a good deal of the secreting parenchyma remains. Finally, if the patient lives long enough, the parenchyma is entirely destroyed and the kidney is converted into a mere shell, surrounded by a thickened capsule and containing cyst-like cavities filled with cheesy pus. The ureter sometimes becomes occluded and the pus has no exit, or the ureter remains patulous and the kidney becomes converted into a small, hard mass of fibrous connective tissue. Interstitial nephritis always ensues after a time and is caused either by the tubercle bacilli themselves or their toxins. Perinephritic abscess often follows as a complication and is formed by an ulceration from the tuberculous deposit extending through the parenchyma and perforating into the fatty capsule of the kidney. The pus is discharged through the sinus thus formed and retained within the fatty capsule. Where one kidney is the seat of a tuberculous deposit the second kidney

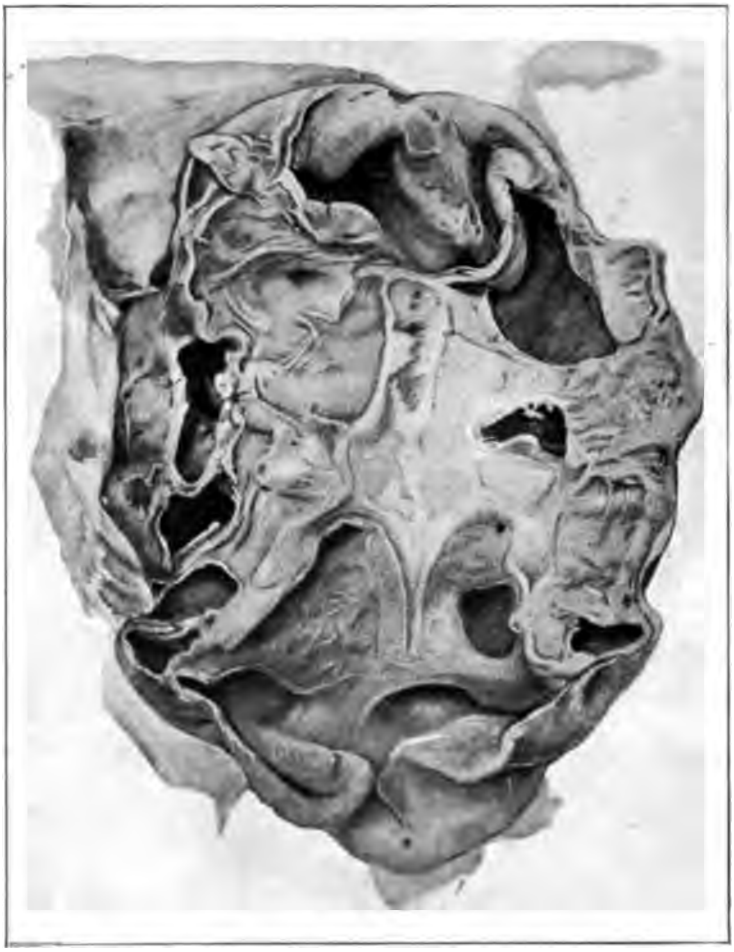
Fig. 259.—Tuberculosis of kidney. Isolated foci have broken down and formed cavities filled with pus, several of which communicate. Nephrectomy. Recovery. (Author's case.)

remains healthy for a time, but ultimately becomes infected through the blood. The fatty capsule of the diseased kidney becomes very much thickened and is converted into dense fibrous connective tissue, closely adherent to the kidney. This adds greatly to the difficulty of nephrectomy, so that subcapsular enucleation of the kidney may have to be performed in order to remove it. The ureters also become affected in a case of long-standing tuberculosis of the kidney. The process in the ureters may be a simple inflammation, in which case the walls become thickened and the canal may be converted into a solid string and agglutinated to the surrounding parts.

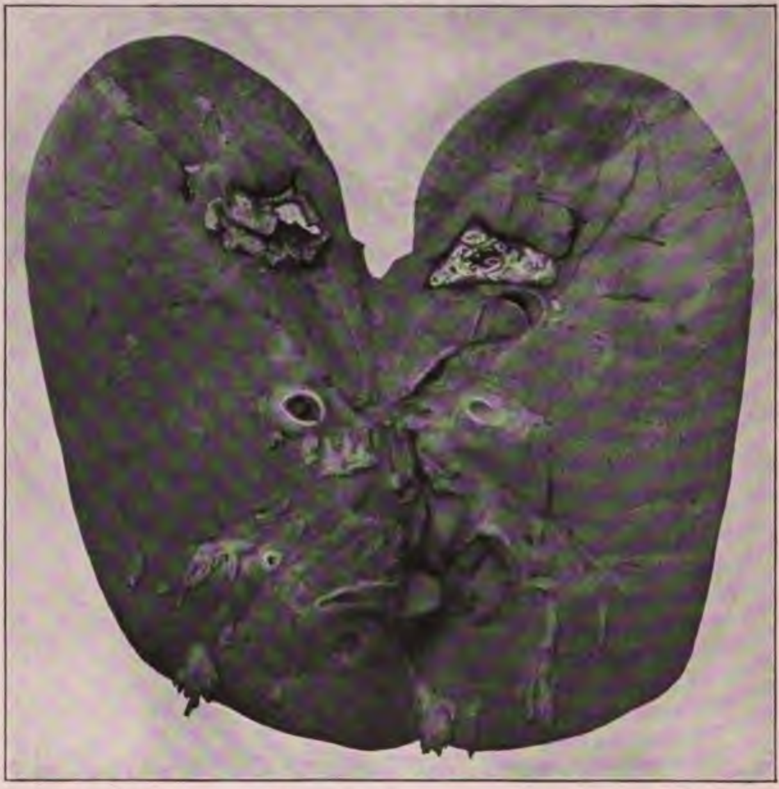

Fig. 260.—Tuberculosis of kidney. Ulceration extending through wall of kidney and perforating into fatty perinephritic capsule, causing a perinephritic abscess to form. Nephrectomy. Recovery. (Author's case.)

If the process is tuberculous, ulcerations and nodules form upon the ureteral mucous membrane.

The bladder nearly always becomes infected with the tubercle bacilli as they descend from the kidney in the urine. Small nodules form under the bladder mucous membrane, which coalesce, break down, and cause the typical ulcers of tuberculosis of the bladder.

## Symptoms

The symptoms of tuberculous kidney are slight at first; a little impairment of the appetite is noted, with perhaps some feverishness at night. Later loss of weight is noticeable, and there is an evening rise of temperature of 101° to 102°. If pyonephrosis or perinephritic abscesses develop, marked septic symptoms follow. If nephritis becomes marked, symptoms of uremia occur; and if the ureter becomes occluded, pains in the loin radiating along the course of the ureter resembling renal colic. The symptoms are not constant, but remissions, with repeated occurrences, are rather characteristic of the disease. In the early stages frequency of urination, particularly at night, is observed; but later when the bladder has become involved with the formation of typical tuberculous ulcers, urination may occur every ten to fifteen minutes. The pain and tenesmus are intense; the urine is foul, containing quantities of pus and more or less blood. The urinary examination shows pus in the urine, unless the focus of tuberculosis does not communicate

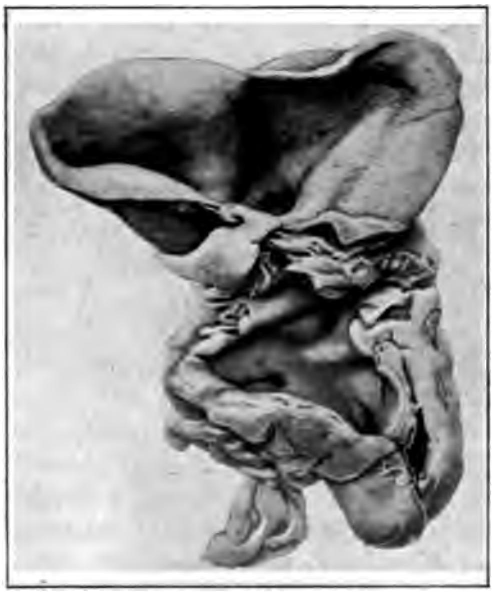

Fig. 261.—Tuberculosis of kidney. Ureter occluded, secreting parenchyma of kidney destroyed, and kidney converted into a mere shell filled with thin pus. Nephrectomy. Recovery. (Author's case.)

the pelvis of the kidney, in which case there is none. When the abscesses break they discharge into the pelvis of the kidney, and pus again appears in the urine. In the early stages a moderate amount of pus is observed in the urine, which is remittent in character, but later large quantities are poured forth. Hematuria may occur, but not necessarily. A free hematuria usually denotes ulcerations at the apices of the pyramids. The urinary examination shows, in addition to the pus cells, polyuria of low specific gravity and acid reaction. Albumin in slight quantities is present and accounted for by pus or blood. If nephritis occurs, considerable quantities of albumin are found, together with granular and hyaline casts. The tubercle bacilli are often difficult to find. Many slides may be examined and none discovered. Pain is not a marked feature of tuberculosis of the kidney, unless the ureter is blocked, preventing the urine from flowing out and damming it back on the kidney. Tumor is difficult to feel, as the kidney is not much enlarged unless pyonephrosis or perinephritic abscess develops. If this occurs, a tumor of considerable size may be easily palpated.

## Diagnosis

In making the diagnosis, the practitioner should *suspect tuberculosis of the kidney in every case of cystitis, especially in young persons, which is not due to stone or stricture and which does not clear up under bladder washing.* Another point which should increase the suspicion of tuberculosis is the fact that a tuberculous cystitis is always *made worse by bladder washing with nitrate-of-silver solution.* The failure to find the tubercle bacilli on examining the urine from the bladder does not exclude tuberculosis of the kidney. If the bacillus is found, it is positive evidence of the presence of the tuberculosis; but it is like the proverbial needle in the haystack and many slides may be examined without discovering one. If the microscopic examination of the urine in a case of cystitis or pyelitis shows pus cells alone, without the presence of microorganisms of any kind, the absence of any bacteria is strongly indicative that the inflammation is tuberculous in origin. If the tubercle bacilli are found, however, it is a positive evidence and the diagnosis is established. Care should be taken not to mistake the smegma bacillus for the bacillus of Koch, which it closely resembles.

A valuable method of determining the presence of tuberculosis in the body is an injection of tuberculin: 1 c.c. of a 1:1000 solution in ½ per cent carbolic acid of old tuberculin Koch, is injected hypodermatically. If reaction follows within a few hours, and the temperature goes above 102°, it denotes tuberculosis in the body somewhere. The writer has found this to be invariably the case, except in the presence of active syphilis. When syphilis is present, a rise of temperature above 102° occurs following the injection, even when no tuberculosis is present in the body. Another method of applying the tuberculosis test consists in the vaccination of the patient with old tuberculin, full strength (von Pirquet's test), or the use of an inunction of 50 per cent tuberculin ointment (Morro's test). While the last two named tests are very reliable in children, they are not of much use in adults, for the reason that nearly all grown persons have a focus of healed tuberculosis in them, and this will give a positive reaction when the tests are used.

The radiographic shadow is also an important adjunct to the examination. An enlargement of the kidney may sometimes be discerned in the increased size of the kidney shadow and if the tuberculous nodules have undergone calcareous degeneration, as sometimes occurs, their presence is easily detected by several small distinct round shadows in the kidney region.

### Animal Inoculations

The most reliable of all the diagnostic tests are the animal inoculations. Guinea pigs are inoculated by injecting into the peritoneal cavity a specimen of the urine drawn from the right and left kidney and the mixed bladder urine. After three weeks the guinea pigs are autopsied, and the presence or absence of tuberculous infection of the pig is proof positive of the condition in the human being.

### Cystoscopy and Catheterization of the Ureters, With a Comparison of the Separate Urines

Cystoscopy and ureteral catheterization afford great help in making a diagnosis. When the urine is loaded with pus which does not clear up under treatment, and the cystoscope shows the bladder to be fairly normal, the conclusion is naturally drawn that the pus comes from the kidney, and on viewing the ureteral opening a stream of turbid urine may often be seen issuing from one or both ureteral orifices.

Characteristic changes are often observed in the bladder, about the mouths of the ureters. The ureter papillæ are congested and studded with ulcerations or hemorrhages.

Willy Meyer describes the appearance of an edematous pouting or prolapse of the mucous membrane around the ureter, with more or less erosion and hyperemic lesion on the part of its periphery, as pathognomonic of kidney tuberculosis.

It is absolutely essential, before advising any line of treatment, to know the condition of the other kidney, and every possible means should be used to determine its functional capacity before operation is considered.

In order to find the relative secreting capacity of each kidney, the ureters should be first catheterized and the separate urines examined.

For the purpose of estimating the relative function of each kidney, chromo cystoscopy by indigo carmine or phenolsulphonephthalein may be used. The phloridzin test may be applied and in combination with one of these the relative quantity of urea secreted by each kidney affords an excellent guide to its functional capacity.

The complicated and unsatisfactory test by means of cryoscopy has now been abandoned and the writer in his work in the Long Island College Hospital depends on the time of appearance of indigo carmine on each side and the quantity of urea secreted by the right and left kidneys simultaneously as a perfectly satisfactory guide to the relative functional capacity of each kidney.

(See Chapter on Tests of Kidney Function.)

**Comparison of the Tests of Renal Activity.**—For practical purposes the comparison of the right and left urines for urea and indigo carmine will give all the information required as to the relative secreting capacity of each kidney, and the complicated and elaborate tests of phloridzin and cryoscopy will not be required, and indeed are now but rarely used, but before any kidney operation is attempted the surgeon should make every effort to learn the secreting capability of each kidney.

It is in this way alone that we can avoid the fatal error of removing a kidney which, although damaged, may be the only one left to the patient.

In the early stages of tuberculosis of the kidney the bladder is not affected and catheterization of the ureters is not difficult for the surgeon who has familiarized himself with the technic of this operation. In the later stages, after the bladder has become involved in the tuberculous process, catheterization is always difficult and sometimes impossible. The bladder is contracted, containing only

2 or 3 ounces of fluid, and the ulcers bleed freely, completely obscuring the view.

It has always been supposed that ulcerations seen with the cystoscope around the mouth of one ureter denoted an affection of the kidney on the same side, but Rovsing[1] has tabulated 100 cases of tuberculous kidney and shows that there is no uniformity about the localization of the ulceration, the ulcers being often located around the healthy ureter or about both ureters, even though one kidney may be healthy.

The use of the Luys segregator has been advised in the cases where it is impossible to catheterize both ureters but unless the bladder is free from ulceration the findings will be misleading, as the urine from kidneys will be contaminated by the pus formed in the ulceration of the bladder.

In the cases which are difficult to examine, the diagnosis has to be worked out step by step. If we can only succeed in getting the urine from one kidney we should endeavor to do so, to determine if the kidney on the side catheterized is healthy or diseased. A view of the ulceration around one or both ureters, together with a decided reaction following the injection of tuberculin, would be sufficient evidence of disease, provided the urine drawn from the bladder showed pus. The presence of tubercle bacilli would be confirmative, but not essential for the diagnosis. In the cases where the diagnosis offers no special difficulty, after the ureters have been catheterized, the right and left urines should be examined. The presence of blood in the urine drawn does not necessarily imply disease on that side, as slight bleeding generally occurs from the traumatism of passing the catheter. The presence of pus in the urine denotes disease of that kidney. A comparison of the urea secreted would show the relative functional capacity of the two kidneys. If the urine from one side shows 10 grains of urea with no pus and no albumin, and the appearance of the blue color eight or ten minutes after indigo carmine was injected, in which urine from the other side shows 2 grains of urea with more or less pus and albumin and a decided delay after appearance of the indigo carmine, it is evident that one kidney is healthy and the other diseased.

Rovsing found that in one-third of his cases where the bladder was involved, the ureters could not be catheterized. The writer has been successful in catheterizing the ureters occasionally in difficult cases with the patient under a general anesthetic, where, on account of irritability of the bladder, it was impossible for it to retain enough fluid.

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[1] Zeitschrift für Urologie, Band 3, Heft 4, 1909.

In the cases when the ureters can not be catheterized, the indigo-carmine test is very important, for, while we do not collect the separate urines, we can note the delayed blue excretion on one side and in that way determine which kidney is affected.

## Prognosis

The prognosis in tuberculosis of the kidney, if treated expectantly, is bad. Pathologists continually discover old scars of tuberculosis in the lungs, but old tuberculous lesions of the kidney are never discovered *postmortem*. If the case is left without operation, the kidney condition grows progressively worse, ending in its complete disorganization, together with involvement of the other.

If one kidney is diseased, it should be removed at once,—before involvement of the other kidney or the bladder. In that case the prognosis is good, and the patient's condition begins to improve immediately after the extirpation of the diseased organ.

The great advancement in the modern treatment of tuberculous kidney is due to Nitze's invention of the cystoscope. In former times it was not possible to determine the functional capacity of the other kidney, and the mortality of nephrectomy was very high. According to the statistics collected by Küster, the mortality of 223 nephrectomies through the loin ranged from 36 to 52 per cent. Since the introduction of modern methods of diagnosis, by which the capacity of the other kidney can be determined, Watson and Cunningham have collected the statistics of 292 cases, with a proportionate mortality of 8.8 per cent. These statistics have been further analyzed by Watson and Cunningham, showing as follows: 54 per cent of patients were cured; 19 per cent died after convalescing, half from the disease, the others from other maladies; 36 per cent showed great improvement, but not a cure.

A further contribution to the end results in nephrectomy for tuberculous kidney has been made by Israel who studied 1023 cases, 170 of them being his own. He found that in three-fourths of the cases operated on a complete cure was established and the ulcers in the bladder healed.

Israel divided the postoperative history into two periods; viz., the first six months after the operation, and later.

In the first six months the mortality was 13 per cent and the mortality of the later period 15 per cent.

Of the late deaths following operation more than one-half occurred by the end of the second year.

Of those dying in the second period pulmonary tuberculosis accounted for 45 per cent; acute miliary tuberculosis, for 14 per cent; and renal failure, for 36 per cent.

The fact that 73 per cent of the fatal cases of pulmonary tuberculosis had definite lesions of the respiratory organs at the time of operation, emphasizes the necessity of a careful examination of the lungs and demonstrates the probability that in most cases of renal tuberculosis there is a coexistent lesion at some other point in the body.

In cases in which death resulted from failure of the renal function, in 30 per cent of them the lesion was nontuberculous, but was some form of Bright's disease, and in 70 per cent the lesion was distinctly tuberculous.

An analysis of the figures would prove that 75 per cent of the patients with tuberculosis of the kidney may be saved by early operation before the involvement of the second kidney. Even if the lungs are already involved life may be prolonged for a period of two years by nephrectomy.

If the patient is in apparently good health two years after the operation his expectation of longevity may be considered as good.

In regard to the question of operation in bilateral tuberculosis, Israel maintains that such a procedure is only to be considered in the presence of an unusually severe focal disturbance, serious hemorrhage occurring at frequent intervals, a harassing pain that resists anodynes, and only then if the other kidney is but slightly involved.

The course of a case which is not operated upon is generally slow. It lasts a considerable time, often several years, before the parenchyma is so much destroyed that the secreting function is badly impaired. Usually metastatic deposits with general tuberculosis occur, and the other kidney becomes the seat of tuberculosis by transmission of the tubercle bacilli through the blood or if this does not occur, it becomes disorganized through chronic nephritis.

Israel states that in the majority of cases presenting tuberculous infection of the second kidney, this organ was either mildly involved at the time of operation or verging sharply upon
thus indicating the need of early operation to save the
ney from being infected.

In the course of kidney tuberculosis the perinephritic tissue becomes involved, suppuration takes place, and perirenal abscess forms.

The symptoms are acute, and consist in painful tumor in the kidney-region, with chills and fever and great prostration.

## Treatment

When both kidneys are affected with tuberculosis, or one is tuberculous and the other badly disorganized from chronic Bright's or amyloid degeneration, the treatment can only be directed to the palliation of symptoms, and consists in forced nutrition, irrigation of the bladder, and, internally, urotropin, gr. viiss t. i. d.; with narcotics to relieve pain.

In the case where pyonephrosis forms, and as a result of the accumulation of pus in the kidney the patient suffers from severe sepsis from absorption, and it is evident that death will occur unless the kidney is opened and drained, a nephrotomy should be done and the pus evacuated.

If the other kidney is diseased, complete extirpation, or nephrectomy, is manifestly impossible, and the operation of nephrotomy is undertaken merely as a palliative measure.

The wound should be left open and allowed to heal by granulation, and usually a permanent fistula remains. The evacuation of the pus, however, relieves the patient of his urgent symptoms and prolongs his life.

When, however, one kidney alone is affected with tuberculosis, and the patient comes under observation early, before the second kidney is involved, it is advisable to remove at once, and completely, the diseased organ.

Even a moderate bladder or lung tuberculosis, if not too far advanced, is not a contraindication for operation; the bladder heals, or at least improves, when the source from which the tuberculous material is poured into it is removed.

It has sometimes been the practice in past years to wait for a spontaneous healing of renal tuberculosis to take place; and while this sometimes happens in rare instances, it is so unusual that it can not be depended upon, and in most cases which are left alone the process extends to the other kidney and to other organs.

Perinephritic abscess forming as a result of tuberculous kidney calls for surgical treatment at once. The pus must be evacuated by a free incision, and the treatment of the kidney itself depends upon the condition of the other one.

# CHAPTER XXXV

## TUMORS OF THE RENAL PARENCHYMA

Well-authenticated cases of renal carcinoma, sarcoma, and malignant adenoma are so few that it is impossible to give any data in regard to their etiology. By far the most important tumor affecting the kidney is hypernephroma.

Of recent years the pathologic investigations on this tumor have been widespread, although formerly sarcoma and carcinoma have been generally confounded with it.

Hypernephroma may, then, be discussed as the type of malignant tumor affecting the kidney, as in the rare cases of sarcoma and carcinoma the symptoms and treatment are identical, and a differential diagnosis can only be made by removing the kidney by operation or at the autopsy table. Hypernephroma was first described by Grawitz, in 1883, and his conclusion was that the tumor originated from aberrant adrenal tissue (adrenal rests), which is so frequently found in the kidney.

When the tumors are small in size they may remain latent in the kidney for years, although they may give rise to metastases which result in death. It is the accepted opinion today that all hypernephromata should be considered malignant because they may assume a malignant character and give rise to metastases.

The duration of the disease is variable. In cases which are not operated upon, the duration may be five or six years or more, but, as a rule, the discomfort is endured about two and one-half years before nephrectomy is submitted to.

The early appearance of metastases shortens the disease, especially when important organs are affected, and the diagnosis of hypernephroma has often been made from examination of the bone tumor which has been removed by operation.

### Symptoms and Diagnosis

An early diagnosis is of the utmost importance to the life of the patient, as, if the kidney is removed soon enough, metastatic deposits will not take place in other organs.

On this account every instance of bleeding from the kidney be regarded with attention, the ureters catheterized, and the functional capacity of each kidney tested.

The tests for renal functional activity of each kidney show that, when the secreting cells have been destroyed and replaced by a new growth, the secreting capacity of that kidney is less than the one on the other side.

The *symptoms* of hypernephroma may be tabulated as follows:

(*a*) Pain in the kidney region, more or less inconstant.

(*b*) Presence of a tumor.

(*c*) Hematuria.

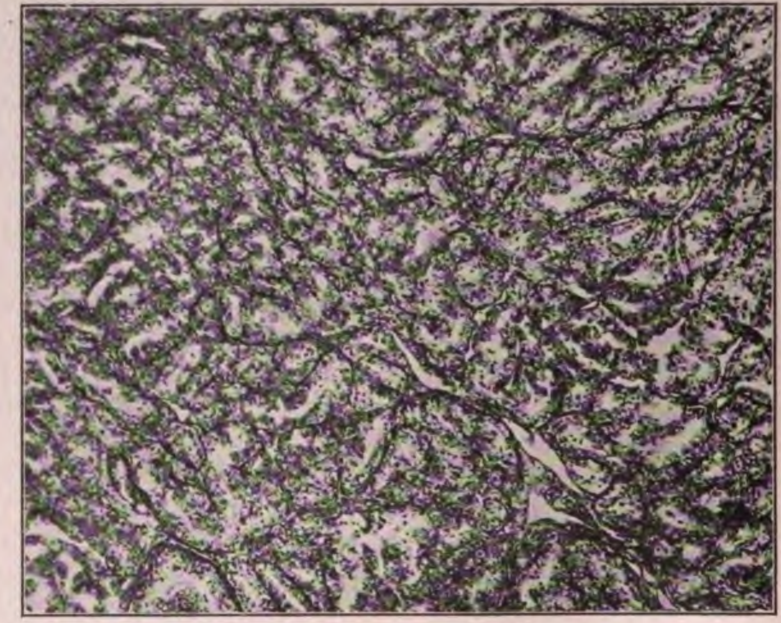

Fig. 262.—Hypernephroma of kidney.

(*d*) Cachexia of cancer.

(*e*) Sudden appearance of varicocele.

(*f*) Rheumatic pains in different bones, and enlargement of lymphatic glands.

Considering the above symptoms in detail of the **changes in the urine** which may occur, the appearance of blood in the urine is the only reliable symptom; while pus cells are often found, they have no particular significance and are due to secondary infection.

The appearance of epithelial cells under the microscope is of little diagnostic importance, for the various cells, both normal and patho-

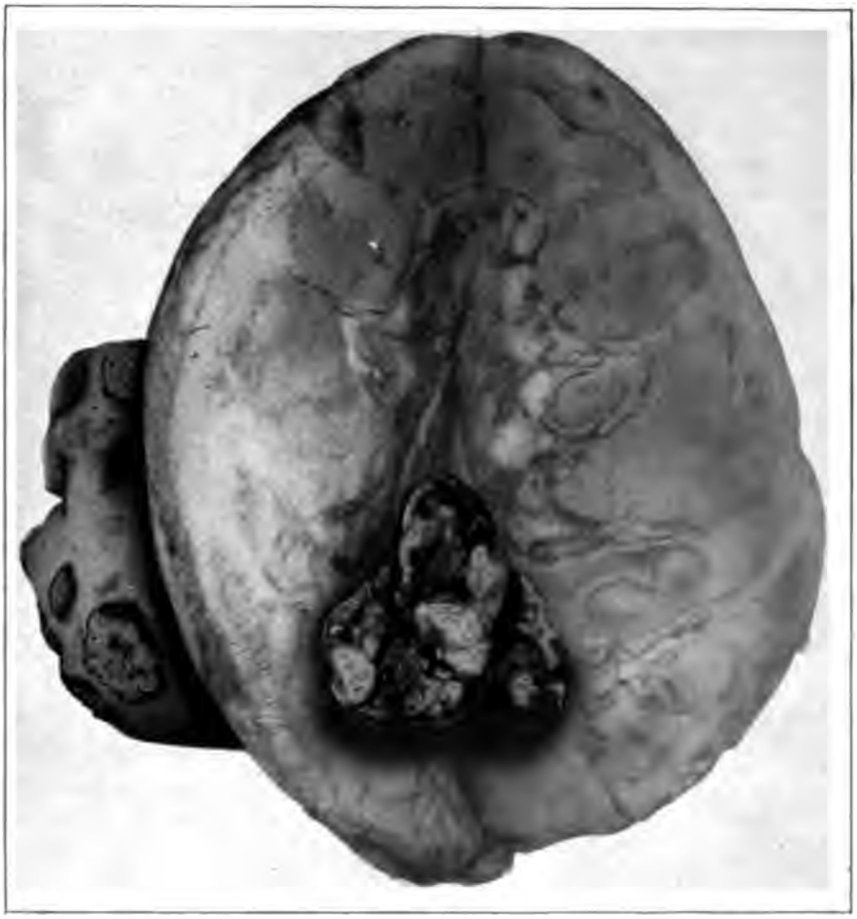

Plate XXX.

Hypernephroma. Nephrectomy. (Author's case, Long Island College Hospital.)

logic, from the kidney, become altered by prolonged contact with urine and are no longer typical.

Albumin and casts may be found after secondary nephritis has occurred.

**The hematuria** may be very free, or may be so scanty that it is only perceptible with the microscope.

It is, of course, of the utmost importance to determine from which kidney the blood issues. This can be done by cystoscopy; the blood may be seen issuing from the mouth of the ureter, or the two ureters may be catheterized.

The bleeding has certain characteristic features to distinguish it from other forms of hemorrhage. It comes on suddenly and without any assignable cause, is uninfluenced by treatment, and ceases without any apparent reason.

The hemorrhage usually occurs early in the disease, but sometimes the tumor exists for some years unnoticed, and the patient's attention is only called to it by a free hemorrhage.

**Cachexia** is a constant symptom and occurs in nearly every case. The emaciation is marked, and on inspection it is evident that the patient is suffering from a serious affection.

**The presence of a tumor** is, of all, the most certain symptom, and it can usually be felt under the free border of the ribs. It is often possible to decide by palpation whether its surface is smooth or lumpy, and also its approximate size.

The tumor may be confounded with other organs in the neighborhood, such as the liver, gall bladder, intestine, spleen, ovaries, ureters, and large uteroperitoneal lymph glands.

If the cancerous deposits consist of small nodes lying deep within the kidney tissues, they can not be felt; or the kidney may be so high up behind the ribs that it can not be palpated.

It will be seen then that the disease must be well advanced before the tumor becomes large enough to be easily felt.

**Varicocele.**—Guyon calls attention to the rapid appearance of a varicocele on the affected side, due to pressure of the tumor on the spermatic veins. This symptom is very inconstant.

**Pains in various bones** are often noticed late in the disease, and are usually due to metastatic deposits in the bones. When these have occurred it is too late for any operative treatment to be of value.

## Differential Diagnosis

While a typical case of well-developed hypernephroma can be easily diagnosed by the presence of a tumor, cachexia, and hematuria, it is often difficult to differentiate beginning malignant disease from other conditions which may give rise to hematuria.

**Idiopathic or essential renal hematuria** may originate from various causes, which have been classified by Keyes as follows:

1. Hematuria—scurvy purpura.

2. Drug poisoning (turpentine, cantharides, etc.).

2. Parasites (e.g., distoma, hematobium—Sondern).

4. Acute or chronic febrile diseases (scarlet fever, malaria).

5. Surgical diseases (hydronephrosis, nephrolithiasis, renal mobility).

6. The passage of urinary crystals.

7. Angioneurosis.

8. Chronic nephritis.

9. Traumatic rupture of the kidney.

A close study of the case may succeed in establishing a positive diagnosis; but we ought not to suspend our efforts to make a diagnosis merely because the hemorrhage has stopped, for if the bleeding is due to hypernephroma it will surely return, and when it does so the time for operation will very likely be past. Hence it is that, after exhausting the ordinary means of diagnosis by palpation, cystoscopy, and catheterization of the ureters, microscopic and chemical examination of the separate urines, if there is still a doubt in the surgeon's mind as to the cause of the bleeding, it will certainly be better for the patient, to do an exploratory nephrotomy. If the condition of the kidney, on examination, makes it advisable, the operation can then readily be converted into a nephrectomy.

**The prognosis,** without operation, is bad, and unfortunately, the diagnosis is often made after secondary deposits have occurred, when operation is, of course, useless.

For this reason the patient's life depends upon making an early diagnosis, and before metastasis has occurred in other organs.

The only **treatment** which can be considered is *nephrectomy,* provided there are no metastatic deposits in other organs, that the other kidney is functionally competent, and that the heart and general condition will admit of a severe operation.

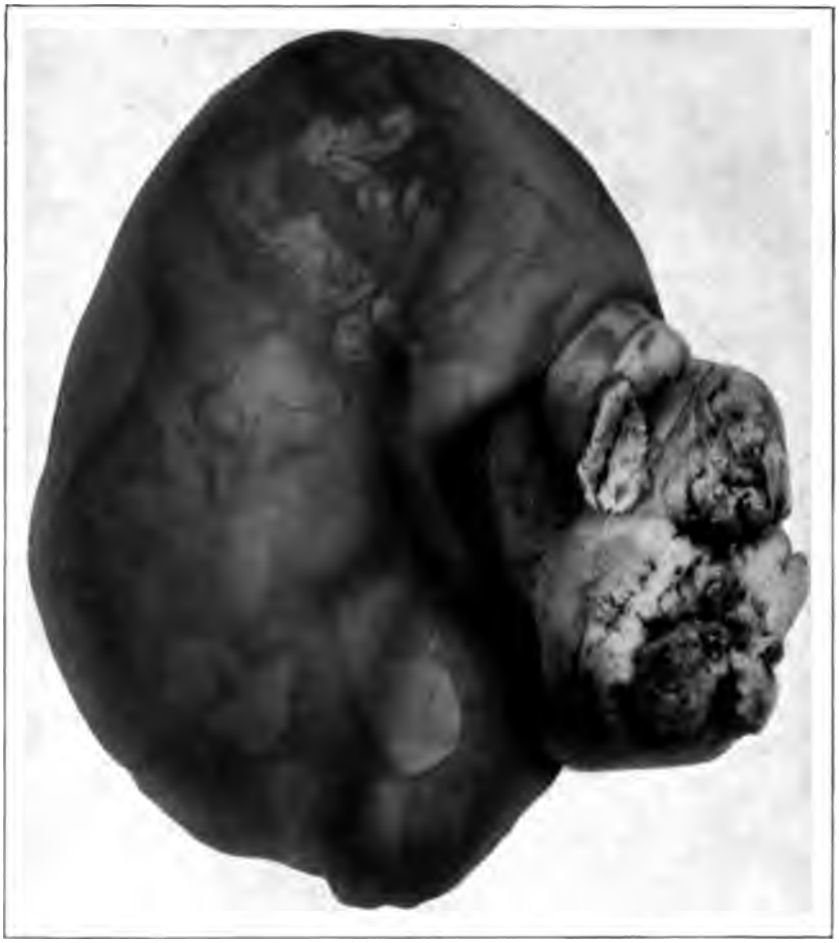

PLATE XXXI.

Hypernephroma. Nephrectomy. (Author's case, Long Island College Hospital.)

## Method of Examination for Suspected Disease of the Kidney

**History.**—*Family history* of tuberculosis, cancer or gout.

*Previous Diseases.*—Pulmonary or genitourinary tuberculosis, gonorrhea, stricture, cystitis, attacks of renal colic, passage of gravel stone, vesical calculus. If the patient is an old man, enlarged prostate and retention of urine.

*Present Symptoms.*—Pain; frequent urination, whether most marked by day or night; hematuria, pyuria, quantity of urine passed, variations in quantity, and fluctuations in amount of pus and blood.

**Physical Examination.**—Palpation of kidney for tumor or tenderness.

*Examination of urine* drawn from the bladder, for reaction, turbidity, specific gravity, albumin, sugar, and urea.

*Microscopic examination of centrifugated sediment* for epithelial cells from kidney, casts, crystals, pus, blood, and microorganisms.

DIFFERENCES IN URINES OF CYSTITIS AND PYELITIS

| *Cystitis* | *Pyelitis* |
|---|---|
| Specific gravity, normal. | Specific gravity, low. |
| Reaction, alkaline. | Reaction, acid. |
| Albumin, scanty. | Albumin, greater quantity. |
| Pus, abundant. | Pus, less in quantity. |
| Casts, absent. | Casts, present. |

**Cystoscopic Examination of Bladder.**—Exclude vesical calculus, tumors, cystitis, ulceration of bladder, enlarged prostate. Note ureteral orifices. Inject indigo carmine and watch for blue stream from ureters.

**Catheterize Ureters.**—Examine right and left kidney urines, and compare.

*Microscope.*—Look for kidney epithelium, casts, pus, blood, crystals, and microorganisms.

*Chemical examination* for albumin, urea, and sugar, if phloridzin was injected.

*Physical Examination.*—Indigo carmine and phenolsulphonephthalein.

**Radiographic picture** if calculus suspected or pyelography.

**Inject peritoneal cavity of guinea pig,** with urine from bladder or kidney if tuberculosis is suspected.

Finally, if impossible to make diagnosis otherwise **exploratory nephrotomy.**

A tabulation of the objective and subjective symptoms of renal lesions has been arranged as follows by Charles L. Gibson:

*Abnormal Mobility.*—History: recognition of displacement by examination; associated neurasthenia and gastroenteroptosis; direct and indirect pain.

*Hydronephrosis, Unilateral.*—Antecedent history of blocking of one ureter; usually by a calculus; large, painless, rounded, fluctuating tumor in the loin; absence of constitutional and uremic symptoms; compensatory hypertrophy of the other kidney.

*Pyelonephritis or Surgical Kidney.*—Usually history of long obstruction, plus infection; mostly elderly men with obstructing prostate and men in middle life with stricture; recognition of the obstruction and cystitis; a low-grade chronic sepsis; occasional acute exacerbations with chills and febrile disturbances; chronic diffuse nephritis; seldom any enlargement or tenderness of the kidney; usually bilateral.

*Renal Calculus.*—The passage of sand, gravel, or small calculi; typical renal colic; attacks of hematuria, especially if accompanying renal colic; symptoms of suppuration in the kidney; local pain and pyuria; recognition of an enlarged kidney due to pyelitis or hydronephrosis; excess of crystalline sediment; temporary oliguria followed by polyuria; gouty or rheumatic diathesis and chiefly in middle-aged individuals.

*Tumors.*—Age: sarcoma in infancy, hypernephroma in later life; cachexia; tumor; pain, hematuria.

*Hydronephrosis, Double.*—History usually of chronic obstruction to the escape of urine from the bladder, or of malignant growth pressing on both ureters; recognition of the source of obstruction.

*Pyonephrosis.*—Antecedent history of infection and obstruction; large globular and fixed tumor in the flank, which is tender on pressure; if process was acute, febrile and other constitutional symptoms; pyuria, which resists all treatment of the bladder, and absence of all symptoms referable to the bladder.

*Tuberculosis.*—History of constitutional tuberculosis; other tuberculous foci, especially of the genitourinary tract; persistent evening rise of temperature; very insidious and latent course of symptoms; polyuria from chronic diffuse nephritis; frequency of urination, even in earlier stages before marked changes in bladder; irregular hematuria without apparent cause; pus thoroughly mixed with urine of an acid reaction.

# CHAPTER XXXVI

## OPERATIONS ON THE KIDNEY

To Simon is due the credit of having first removed the kidney through an incision in the loin without entering the peritoneal cavity, and this is the method of choice which is applied to nearly every case today.

The transperitoneal approach to the kidney was also experimented with, but is now abandoned in general and only reserved for very exceptional cases, for the lumbar route is less dangerous to life, less damaging to the tissues, as it affords the most direct approach to the kidney and offers inestimable advantages for the after-treatment.

The kidney in its normal position lies with its greater part concealed by the borders of the ribs, only about one-third of its substance lying below them. On this account it is impossible to expose the kidney freely without dislocating it and bringing it downward from its bed into the wound. As a rule, the right kidney lies somewhat deeper than the left and is more liable to become movable.

The pedicle of the kidney is composed of the vein, artery, and ureter, the artery lying behind and the vein in front. Aberrant vessels are often found, particularly accessory veins, which course from the pelvis out to the parenchyma.

The pedicle is so inelastic at times that even after all the adhesions are freed it is very difficult to bring the kidney up on a level with the surface of the wound.

The ureter runs from the pelvis diagonally downward upon the psoas major, crossing the iliac artery just before it reaches the bladder.

The kidney is closely surrounded by a thin capsule of fibrous tissue (the capsula propria), and this is again enveloped in a fatty capsule (capsula adiposa), which is of varying thickness.

On exposing the kidney the fatty capsule is torn away, but the capsula propria remains.

Reference to the illustration shows the relation of the peritoneum, and the arrow denotes the route by which the kidney can be reached without opening the peritoneal cavity.

The lateral wall of the erector spinæ, which can often be felt, serves as a landmark for the posterior border of the incision; more anteriorly the three layers of the oblique abdominal muscles come into view, and if the incision extends upward a larger part of the latissimus dorsi appears in it. The transversalis fascia stretches between the muscles and the kidney fat.

In Fig. 222 the two forms of incision in common use are shown:

(*a*) *The Longitudinal Incision of Simon on the Border of the Erector Spinæ.*—It begins at the border of the twelfth rib and extends directly downward; none of the muscles are cut through, and the peritoneum is at a considerable distance from it.

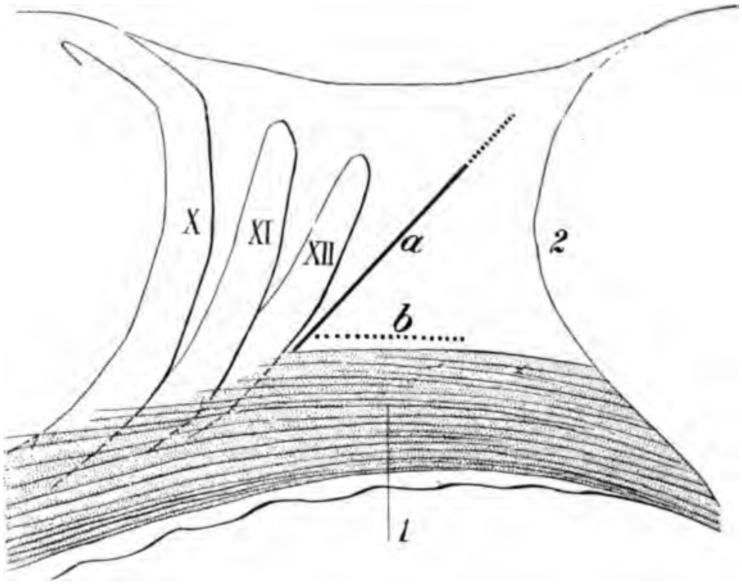

Fig. 263.—Lines of incision for exposing kidney. *a*, oblique incision, may be extended along dotted line; *b*, longitudinal incision of Simon; *1*, erector spinæ or sacrolumbalis; *2*, crest of ilium.

While it causes but little damage to tissues, it permits only a limited exposure, and it is only possible to bring out of the wound a kidney which is small and not abnormally fixed.

For this reason the Simon incision is only used today in cases where it is not necessary to bring the kidney out on the flank, as in nephropexy and incising perinephritic abscesses.

(*b*) *The oblique incision of von Bergmann* is the one in general use today, although many operators have slightly modified its direction.

The patient lies upon the sound side, supported upon a half-round wooden block so that a wide space exists between the ribs and the ilium.

The incision is begun at the junction of the twelfth rib and the erector spinæ muscle about three fingerbreadths from the spine and extends obliquely downward and forward just below and parallel to the twelfth rib.

The incision divides the skin, fascia, and last fibers of the latissimus dorsi, exposing the lateral border of the erector spinæ; from this point the oblique abdominal muscles are cut layer by layer and then the transversalis fascia, taking great care not to wound the peritoneum.

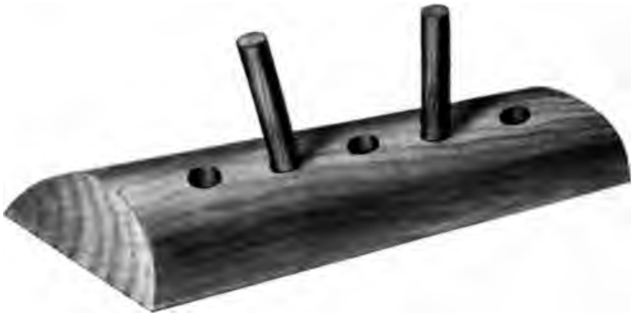

Fig. 264.—Block for supporting patient in kidney operations.

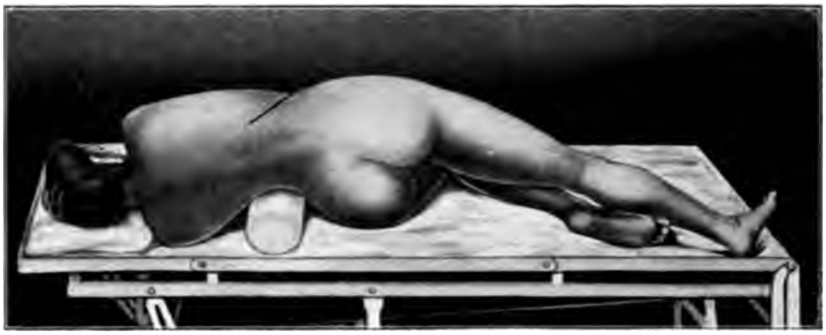

Fig. 265.—Patient in position for exposure of the kidney.

The iliohypogastric nerve is seen coursing over the quadratus lumborum; it is pushed backward and held, together with the divided muscles, by a blunt retractor.

The position of the kidney is then made out by palpation.

The index fingers of both hands are then introduced into the kidney fat and the fatty capsule exposed. The capsule is graspe with anatomical forceps and a small incision made in it; the inde fingers are introduced into the opening thus made, and the fatty capsule is torn through in a longitudinal direction and the kidne palpated.

The anterior layer of the fatty capsule, together with the peritoneum, is pushed forward and held out of the way with a blun retractor; in this manner the peritoneal cavity is protected from being accidentally wounded during the entire operation.

The surgeon's hand is then introduced into the wound, and separates the kidney from its fatty capsule, which remains *in situ*,

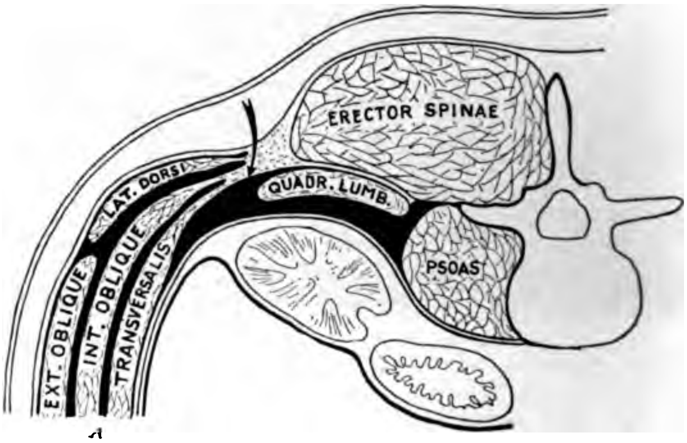

Fig. 266.—Diagram of section through region of loin at height of twelfth rib. The arrow shows the route of approach to the kidney, retroperitoneal, with least injury to the muscles. (After Schmieden.)

and the attempt is made to draw the kidney up out of the wound.

This maneuver can be aided by an assistant making firm counter-pressure over the abdomen with the closed fist.

After the kidney has been brought out of the wound on the flank, the remainder of the imbedding fat is pushed back, bringing into view the pelvis, the blood vessels, and the ureter.

After completing the operation on the kidney, the steps of which are described subsequently, it only remains to close the wound cavity.

It should be remembered that a distinct disposition to lumbar hernia remains, as the divided abdominal muscles and fascia do not always unite firmly and a subsequent operation for hernia may have to be undertaken. For this reason it is necessary to unite all the layers divided, by means of sutures.

Partial drainage of the wound is required in most cases, the exceptions being in a simple exploratory operation where the kidney is found to be healthy, and only then when it was possible to stop all hemorrhage and when the kidney substance was not injured.

The cavity remaining after a kidney extirpation always requires temporary drainage and a tampon, as well as the cases where the kidney was incised.

In the presence of infectious processes the wound should be treated open and filled with a Mikulicz tampon and only the anterior part sewed, the drainage tube and tampons being brought out from the posterior angle of the wound in the region of the erector spinæ.

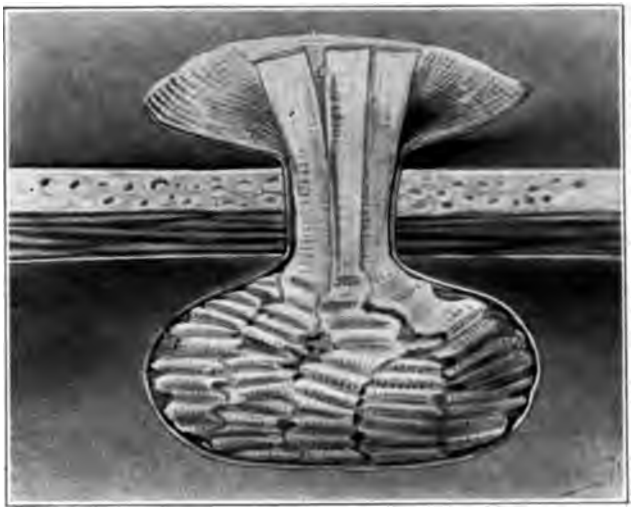

Fig. 267.—Mikulicz tampon showing outer layer of gauze filled with gauze strips.

The freeing and dislocation of the kidney as above described are often attended with considerable difficulty, especially in the case of individuals with fat abdomens or with large tumors of the kidney, and especially in the cases where the kidney is considerably enlarged and adherent to the neighboring structures or imbedded in a heavy mass of cicatricial tissue.

In such cases the isolation and exposure of the pedicle may be attended with extreme difficulty, and the following measures will prove of assistance.

In the first place the incision may be prolonged as far forward as is desirable, in extreme cases to the rectus abdominis, dividing at the same time the peritoneum.

This temporary division of the peritoneum for large tumors is often very helpful, and is sometimes made solely for the purpose of palpating the kidney on the other side.

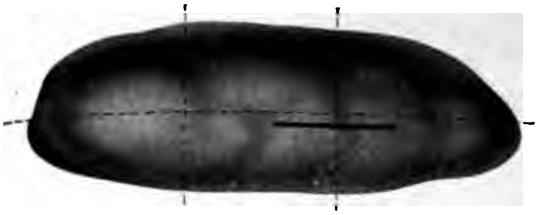

Fig. 268. -Line of incision in nephrotomy for exploring pelvis of kidney. (After Albarran.)

The peritoneal cavity should be closed as soon as possible, and accidental wounds of the peritoneum sutured at once.

The incision may be prolonged posteriorly by partial division of the edges of the erector spinæ and quadratus lumborum, and a great deal of extra space can be secured by resection of the twelfth

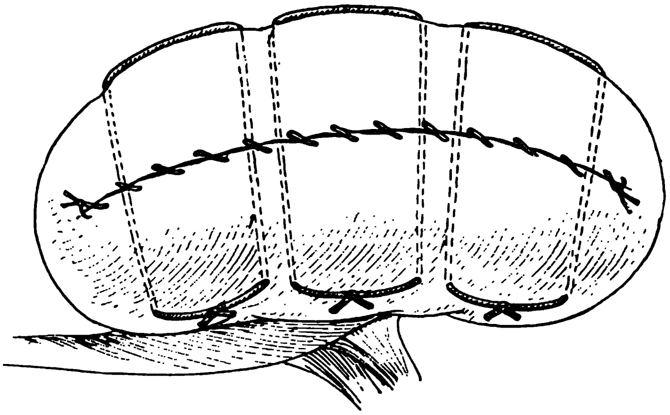

Fig. 269.—Method of suturing a kidney. Continuous suture through edges of incision and mattress sutures, if necessary to control hemorrhage.

rib; to avoid wounding the pleura the resection must be made after stripping up the periosteum, and it should be remembered that the pleural cavity sometimes extends below the twelfth rib.

In spite of these measures, it sometimes happens that the delivery of an enlarged kidney is impossible. In such cases, where the kidney is a solid tumor it may be removed by subcapsular enucleation, leaving the thickened and fatty capsule adherent to the surrounding tissues.

Large cystic tumors or hydronephroses are first emptied by means of the Potain aspirator, and when the fluid is removed they are transformed into a collapsed sac, which allows itself to be easily withdrawn through a small opening.

*The exposure of the ureter* in its upper part is easily attained by means of the incision above described for the kidney. The lower part may be brought into view by a prolongation of the oblique lumbar incision; in the middle axillary line the incision departs from the direction of the twelfth rib, and is carried forward over the anterior superior spine and as far forward as necessary, above and parallel with Poupart's ligament.

Fig. 270.—Deschamp's ligature carrier.

In this way it is possible to inspect the entire ureter and incise it and remove a stone if present; with the aid of this incision one can also remove the entire diseased ureter from the kidney to the bladder in cases of nephrectomy for tuberculosis.

Fig. 271. Calculus of ureter of several years' duration. Removed by extraperitoneal route. (Author's case.)

*The exposure of the lower third of the ureter* requires an entirely different approach and is only called for in the case of ureteral calculus impacted in the pelvic portion of the ureter.

The patient is placed in the Trendelenburg position and an incision parallel with Poupart's ligament and one inch above it made from the spine of the ilium to the inguinal ring. The skin, fat, and muscles are divided down to the peritoneum, which is not opened. The peritoneum is pushed back until the iliac artery is clearly seen at the bottom of the wound.

The ureter will be seen crossing the bifurcation of the common iliac, and this serves as the landmark for it. The ureter will be found adherent to the peritoneum and lying like a white band of tape within its folds.

The ureter can be examined with the fingers, and when the stone is felt the ureter should be incised in its long axis, not at the point of dilatation, but a short distance from it, so as to secure healthy tissue for the subsequent suture.

The stone may be grasped with alligator forceps and removed and the wound in the ureter closed with catgut sutures, which should be left long and used to tie around the end of a gauze tampon to keep it in close contact with the incised ureter and prevent it from being pulled out accidentally. When the catgut softens, the gauze comes away. The wound in the abdominal wall is then closed in the usual manner, except at the lower angle, where the gauze protrudes.

Some leakage of urine always occurs, but ceases when the wound in the ureter fully unites, as it always does, for longitudinal wounds of the ureter heal readily without leaving a fistula.

## NEPHROTOMY AND NEPHROLITHOTOMY

The operation is begun by luxating the kidney through the oblique incision already described; after this is accomplished the kidney is examined to see if a focus of disease is perceptible to the touch or vision, and the pelvis of the kidney is palpated for a stone.

A stone which is present in the substance of the kidney may be found by transfixion with a thin, straight needle introduced at various suspected points.

A clear understanding of the condition of the parenchyma and the kidney pelvis can best be obtained by splitting the kidney longitudinally.

Since Zondek's investigations of the blood supply to the kidney the incision should be made ½ to 1 cm. behind the anatomic median line, so that the posterior half is smaller than the anterior, as in this way fewer large vessels are injured.

Before incising the kidney a pedicle clamp, both blades of which are protected by rubber tubing drawn over them should be placed upon the vessels; otherwise, the hemorrhage is very free, rendering inspection difficult. The clamp should not include the ureter, as this would interfere with the introduction of a sound for exploratory purposes.

The incision should lay open the pelvis of the kidney, and is followed by inspection of the parenchyma, extraction of stones, and before finishing a long probe or bougie à boule No. 16 should be passed down the ureter to detect a ureteral calculus.

If the kidney is not to be extirpated, the incision should be partially or entirely closed with sutures.

Several mattress sutures of catgut should be placed to hold the cut surfaces in place and control the bleeding, and finally a continuous catgut suture passed through the capsule and edges of the incision to hold them together.

Care must be taken not to draw the sutures too tight; otherwise, they will tear out of the tender parenchymatous tissue.

The pedicle clamp is removed and the amount of reactive hyperemia noted.

In infected cases it is safer to introduce a drain between the sutures, and the wound in the flank is also left partially open and drained. For exploration of the kidney pelvis and removal of a small stone from it a short incision is sufficient; the examining finger is introduced through it, the incision held open with blunt retractors, and the stone removed with lithotomy forceps.

Such incisions should be sutured in the same manner as the larger ones, and the same principle is applied to suturing a ruptured kidney when it is to be saved.

With septic processes, or with sacculated kidneys which can not be extirpated, it is proper to return the kidney to its bed without suturing, provided it be filled with gauze tampons or the edges of the kidney incision sutured to the edges of the skin (nephrostomy).

In cases of nephrotomy where the surgeon fears the danger of secondary hemorrhage, two long gauze strips may be placed under the kidney at its upper and lower poles and the ends brought out of the wound.

If hemorrhage occurs, the kidney may be raised up, brought out of the wound by drawing on the ends of the strips, and the hemorrhage controlled or the kidney extirpated (Bockenheimer).

## PYELOLITHOTOMY

Pyelolithotomy is adapted to small stones in the pelvis of the kidney, and has the advantage of not causing damage to the parenchyma or much hemorrhage.

The kidney is exposed and brought out on the flank, and an incision is made in the upper end of the ureter, which may be extended upward with the pelvis of the kidney if necessary and the stone grasped and removed with lithotomy forceps.

A rubber drainage tube should be inserted through the wound in the ureter, into the pelvis of the kidney, and the wound in the ureter closed around it with Lembert sutures of catgut. Silk should never be used in any kidney incision, on account of the danger of urinary concretions forming.

## NEPHRECTOMY

The kidney is exposed and brought out upon the flank as already described. If necessary, a nephrotomy may be done, and if it is decided to remove the kidney the most important part of the operation consists in the *treatment of the pedicle.*

The vein artery, and ureter should be brought into plain view by pushing away the surrounding fat with gauze sponges or preparation with anatomic forceps.

When the exposure is complete the ureter should be tied with a double ligature and cut between them or preferably burned through with the Paquelin cautery.

The artery and vein are best dealt with by passing a heavy ligature of catgut or kangaroo tendon by means of a Deschamps ligature carrier around each separately and tying firmly. The pedicle is grasped between the knot and the kidney with a Kocher clamp and the kidney cut off above it with scissors. The ligatures should be placed as far from the kidney as possible, so that a long stump is left to prevent the danger of the ligature slipping off.

After the kidney is cut away, the pedicle, which is held by the Kocher clamp, is inspected for hemorrhage and the vessels ligated again for security, and the pedicle is allowed to drop back only after the surgeon has assured himself that the hemorrhage is controlled

Great difficulties may be encountered in ligating the vessels in the case of a short pedicle or one which is imbedded in cicatricial tissue

In such an instance the vessels must be seized with a clamp as low down as possible, while an assistant holds the clamp firmly, for if it slips [illegible] uncontrollable hemorrhage occurs [illegible] clamp, it is always safer to use two, applied at right angles on the pedicle, so that if one should slip, the other may hold. The kidney is then cut away and the artery and vein picked up and tied separately.

A mass ligature should never be applied with the clamp in place, as there is always the danger that the mass of tissue is so thick that the ligature will not hold, but will slip off.

If these maneuvers are not successful and more space is needed for the ligation, it is safer to resect the twelfth rib, which will give ample room for the manipulations.

## NEPHROPEXY

The longitudinal incision of Simon at the border of the erector spinæ is well adapted to this operation, which can be considered in two parts:

(*a*) The replacement of the organ in its normal position.

(*b*) Securing it in place.

The Simon incision is held apart with retractors, and the kidney exposed on its convexity and a part of its posterior surface, and held in place by an assistant.

For its fixation innumerable methods have been invented and described, demonstrating how unsuccessful the results of fixation often are.

For a successful operation it is necessary that neither fat nor blood clots interpose between the kidney and the posterior abdominal wall to prevent the close adhesion, and that a strong cicatrix forms between the kidney substance and the abdominal wall.

It is desirable to cut away as much of the fatty capsule from the wound as possible in every form of operation for fixation of the kidney. The three methods in common use today are described as follows:

**Guyon's Method.**—The kidney is partially decapsulated by stripping off the fibrous capsule from its convexity and part of the anterior and posterior surfaces.

The first suture is passed around the twelfth rib and through the parenchyma of the kidney by means of a Reverdin needle.

The second suture is passed through the muscle on the anterior surface of the wound, through the kidney, and through the muscle on the posterior surface of the wound.

The external wound may be closed without drainage.

In order to avoid passing the suture through the kidney sub-

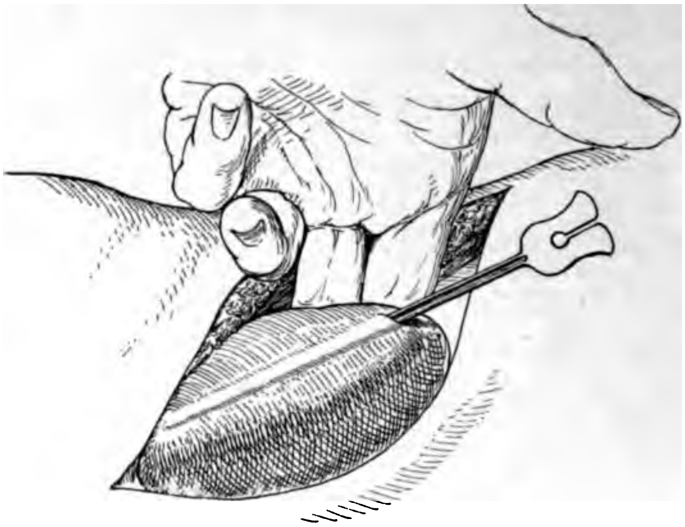

Fig. 272.—Nephropexy. A grooved director is passed under fibrous capsule of the kidney, preliminary to stripping it off.

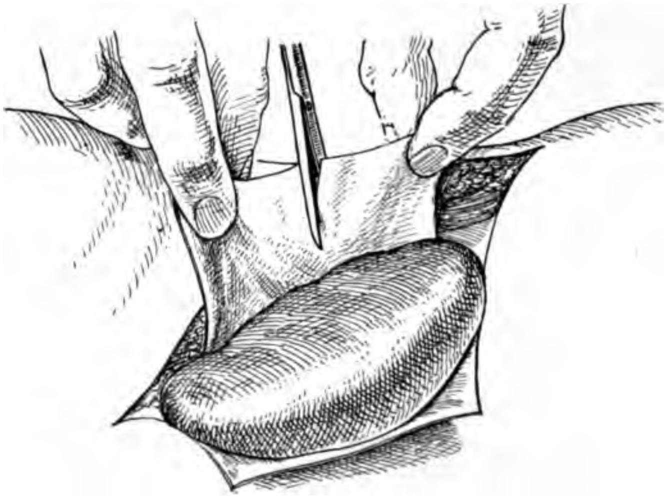

Fig. 273.—Nephropexy. Albarran's method. The anterior part of the fibrous capsule is split in two halves.

stance, and the possible danger of the formation of concretions, the following method is preferable:

**The method of Obalinski** is also successful, and has the advantage of avoiding the sutures passed through the kidney parenchyma.

The object of the operation is to prevent primary union of the outer wound and cause the formation of a firm cicatrix, which fixes the kidney in place and attaches it to the skin.

After exposing the kidney a small part of the proper capsule is stripped off to make a raw surface to form adhesions.

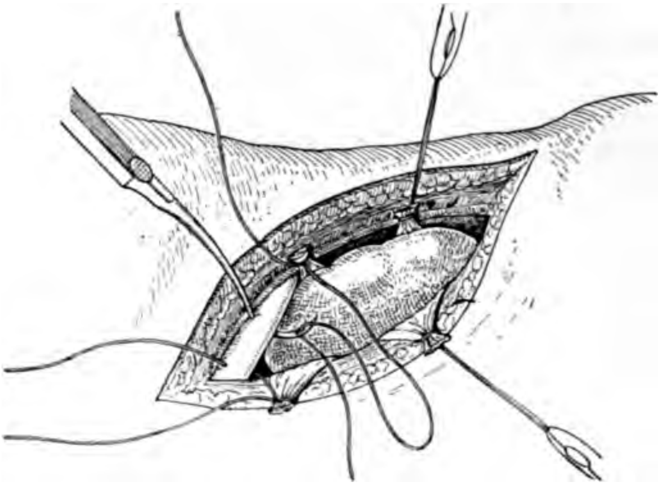

Fig. 274.—Nephropexy. Albarran's method. Sutures attached to stump of decorticated capsule. Upper sutures passed around twelfth rib and lower sutures through muscular margins of wound.

The fatty capsule is sutured to the muscles, and if possible the sutures are carried through the loosened capsula propria. The skin wound is not closed, but kept open by a gauze tampon, which is left in place for a week. The wound heals by granulation, forming a firm, strong scar extending from the kidney to the skin, fixing the organ and holding it in place.

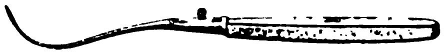

Fig. 275.—Reverdin needle.

The patient must remain in bed for three weeks.

**Albarran's Method.**—The kidney is exposed by the oblique incision and the capsula propria is entirely stripped off from the kidney, forming an anterior and a posterior flap.

The anterior and posterior flaps are each divided into two halves and tied with chromicized catgut, leaving the ends long.

The twelfth rib is exposed and the two upper sutures passed around it with a Reverdin needle, and the ends tied, fixing the kidney in place. The two lower sutures are then passed through the muscles at the edge of the incision and the ends tied in the same way.

The operation is finished by introducing a small drain (Albarran) and closing the wound with buried sutures.

Albarran's method of fixing the kidney is to be preferred; it is technically simple and the kidney is more apt to remain in place than after operation by the other methods.

## RESULTS OF OPERATIONS ON THE KIDNEYS

In no class of surgical cases is the reduction of mortality, due to improved operative and diagnostic technic, more striking than in operations on the kidney.

The statistics as presented by Küster are most instructive. In the years 1861 to 1869, nephrectomy was done on 5 patients, with a mortality of 80 per cent.

In 1882, Harris reported 50 cases, with a mortality of 38 per cent; while in 1902 the collected reports of Küster on 1067 cases of lumbar nephrectomy show a reduction in the death rate to 12.08 per cent.

Küster's records also show that nephrectomy by the abdominal route has a mortality of 34 per cent, or nearly three times as great as when the operation is done through the loin without opening the peritoneum.

**Results of Nephrotomy and Nephrolithotomy.**—The mortality of nephrotomy, for various conditions, can be noted by reference to Küster's collected statistics:

For pyelonephritis, 92 cases operated, 17.39 per cent died.
For renal calculus, 487 cases operated, 18.27 per cent died.
For cysts of kidney, 150 cases operated, 6.66 per cent died.

It is evident from these figures that the cystic kidney offers the best prognosis for operation, not because nephrotomy *per se* is less formidable than for other conditions, but the disease in itself is one which does not immediately threaten life.

Nephrotomy for calculus or pyelonephritis, on the other hand, is attended with a higher death rate on account of the extreme damage to the secreting structures of the kidney, the depreciation of the patient's vitality, and the danger of prior involvement of the other kidney.

**Results of Nephropexy.**—The results of these various methods ill probably be found to compare favorably one with another, alough Henry Morris, Tillmanns, Tuffier, Keen, and others believe at passing the sutures through the parenchyma of the organ furishes a larger percentage of successes than other methods of proedure.

The mortality of the operation is very slight, running from 2 o 4 per cent when it is performed under favorable auspices.

According to Albarran, in 88 per cent of the cases that recovered, the pain was cured. In 14 per cent nervous symptoms were partially cured; but 36 per cent were not benefited in this respect.

Keen reports 134 cases of nephrorrhaphy, and of the cases treated by suture of the fatty capsule only 26.6 per cent were failures; of those treated by suture of the fibrous capsule alone, 25.9 per cent were failures, while of those treated by suture involving the kidney substance only 13.5 per cent were failures.

Watson and Cunningham's statistics of 158 cases reported show much more favorable results than the above. The analysis shows the following:

| | |
|---|---|
| Absolute cures | 132 |
| Great improvement | 18 |
| Failures | 8 |
| | 158 |

The patients were under observation from one to twenty years after the operations were performed.

BIBLIOGRAPHY

**Albarran**: Med. Op. des Voies Urinaires, 1909.
**Boland**, Frank K.: Urol. and Cut. Rev., 1916.
**Brewer**, G. Emerson: New York Med. Jour., March 20, 1915; Surg., Gynec. and Obst., May, 1906.
**Cabot**, Hugh: Jour. Am. Med. Assn., Oct. 9, 1915.
**Cabot** and Crabtree: Tr. Am. G. U. Surg., 1916.
**Caulk**: Jour. Am. Med. Assn., March 3, 1917.
**Eisendrath**: Jour. Am. Med. Assn., Feb. 19, 1916; New England Branch, Tr. Am. Urol. Assn., 1916.
**Garceau**: Tumors of the Kidney, 1909.
**Gibson**, C. L.: Med. Rec., New York, Jan 7, 1905.
**Greene** and **Brooks**: Diseases of the Genitourinary Organs, 1917.
**Guiteras**: Urology, 1912.
**Hagner**, Francis R.: Virginia Med. Month., April 23, 1915.
**Keyes**, E. L.: Surgical Diseases of the Genitourinary Organs, 1903.
**Kretschmer**: Jour. Am. Med. Assn., March 3, 1916.
**MacCallum**: Pathology, 1917.
**MacGowan**, Granville: Jour. Am. Med. Assn., Jan. 16, 1915.
**Marsh**: Brit. Jour. Child. Dis., Sept., 1913.
**Morris**, Henry: Surgical Diseases of the Kidneys and Ureter, 1901.

Within very recent times the interest of surgeo
strongly directed toward the cure of chronic nephritis
off the capsule of the kidney.

A brief history of the development of the operation
out of place.

In 1896, R. Harrison[1] reported 3 cases of patients su
nephralgia and hematuria where the kidney was cut
in the expectation of finding a renal calculus or pyeliti
ous cause for the symptoms was discovered, but the pai
and albuminuria disappeared after the nephrotomy,
tients completely recovered.

Harrison attributed the success of the operations
of tension accompanying the inflammation of the ki
followed a division of the kidney.

He also drew the conclusion that interference with
kidney on one side benefited the function of the ot
plained it by assuming that there was a sympathetic c
tween the two kidneys.

Israel[2, 3, 4, 11] also reports cases of unilateral hema
phralgia upon which he did nephrotomy which were su
due to calculus, but were in reality cases of chro
disease.

Of 14 cases which he operated upon, 2 died of s
nephritis, and 6 recovered completely. In 3, the s
curred after prolonged intervals, and in 2 the nephr
failure.

Israel disclaims any intention of curing chronic Bri one kidney has been operated upon by assuming that the disease is confined to one kidney and that the other is healthy.

He calls attention to the well-known fact that a tissue which is the seat of chronic inflammation usually takes on healthy action when the diseased structures are split, and he believes that after nephrotomy new venous channels form between the kidney and surrounding structures, in this way relieving congestion and lessening the intracapsular pressure.

Pousson[5, 6] also reports cases of chronic Bright's disease where nephrotomy was done by himself and others.

He explains the good results obtained by assuming that the nephrotomy relieves the pressure and permits the secreting cells of the kidney which are still undamaged to resume their function.

Pousson, however, is of the opinion that nephrotomy should only be done in desperate cases of uremia where the usual medical treatment has entirely failed.

Edebohls,[7, 8, 9, 10] of New York, was the first surgeon to operate on cases which had been diagnosed as chronic Bright's disease with the object of curing that condition by operation.

While in England, France, and Germany surgical measures were undertaken for the relief of renal hematuria and pain, or of desperate cases of uremic poisoning, in this country Edebohls conceived the idea from his work in anchoring movable kidneys, and observing the improvement which occurred in the accompanying nephritis.

His next step was to operate primarily for the cure of nephritis in cases where the kidney was not movable, by stripping off the capsule of the kidney instead of merely doing nephrotomy, as has been the practice of the European surgeons.

As to the *modus operandi* by which renal decapsulation exerts a favorable influence on chronic Bright's disease, Edebohls believes that by removing the impervious capsule of the kidney an opportunity is created for the formation of new vascular connections between the blood vessels supplying the secreting structures of the kidney, on one hand, and the blood vessels surrounding the kidney, on the other.

Edebohls made his first observations on three cases that had been operated on for nephropexy. He noted that the strong connective-tissue adhesions, or bands, attaching the kidney to its surroundings, contained large and numerous blood vessels running between the kidney and its adjacent tissues.

The newly formed arteries predominated in size over the veins, and in all the arteries the direction of the blood stream was *toward* the kidneys.

Edebohls believes that the increased blood supply leads to an absorption of the interstitial or intertubular exudates, freeing the tubules from compression and promoting a reestablishment of the normal circulation, with regeneration of epithelium capable of carrying on the secreting function.

The views of pathologists are strongly opposed to these explanations.

Van Cott and Murray,[12] in their experiments on dogs in the Hoagland Laboratory, found that after stripping the capsule, a new, thick capsule was formed, with capillary and not arterial anastomoses. They also state that the elaborate researches of Marchand, Barth, and others prove undoubtedly that where extensive destruction of the renal tissue occurs repair is imperfect, and never to the degree of a restoration of functional activity.

Johnson[13] also found, in his experiments on dogs, that the new capsule which formed was thicker than the original one, and without anastomoses between the renal and perirenal vessels.

It is thus evident that clinicians and laboratory workers are at variance in explaining the anatomic basis of improvement after decapsulation.

Pel, Jaboulay, and others have suggested that the improvement comes more from the reaction of the operation upon the sympathetic ganglia, rather than from the increased blood supply to the part.

The first beneficial effects of the operation do not appear before the tenth day, and are explained by Edebohls as probably due to the manipulation of the kidney during the operation, which acts as a massage and stimulates its natural blood supply.

He also states that the new capsule forms in from three weeks to three months after stripping, that it is sometimes thicker and sometimes thinner, but always more succulent and vascular than the original.

The *classification* of chronic Bright's disease varies greatly with different authorities, and is more confused by the fact that different pathologic lesions always exist at the same time and in the same kidney.

Edebohls classifies as *interstitial nephritis* those cases in which inflammation of the connective tissue predominates, *parenchymatous nephritis*, in which involvement of the secreting apparatus forms the salient feature, and as *diffuse nephritis,* in which both parenchyma and connective tissue are equally involved.

The knowledge that a unilateral chronic nephritis can exist is a fact which has been unknown until very recently. Out of 72 cases of chronic Bright's disease operated upon, Edebohls found that in 11 cases one kidney alone was affected.

Unilateral disease of the kidney was found to exist more frequently among the milder and less advanced cases, for as the disease progresses the other kidney becomes involved as well, so that Guiteras[10, 15] found, in looking over the autopsy reports in 500 cases of chronic Bright's disease, that in not one instance could it be said that the nephritis was unilateral.

The length of time elapsing before the involvement of the second kidney probably explains the chronic course of a great many cases of Bright's disease in which the general health suffers but very little. The healthy kidney does the eliminative work for both organs, and uremia does not occur until the second kidney becomes badly disorganized.

As to the **indications for renal decapsulation,** Edebohls regards as suitable any patient with chronic Bright's disease who has a reasonable expectation of not less than a month of life without operation and who can stand the administration of an anesthetic. As the beneficial results of the operation do not appear for ten days, the above proviso is made.

In itself, the operation of renal decapsulation is one in which the danger to life is very slight, if undertaken before cardiac and vascular changes have occurred.

This is shown by Edebohls in his results in cases of nephropexy. He decapsulated and anchored both kidneys in 73 cases, with only one death.

Among the **contraindications** which bar out operation may be considered, first, dilatation of the heart, which predominates over hypertrophy accompanied by *insufficiency of the aortic valves* with an intermittent aortic regurgitant murmur with every third or fourth beat.

In such a case there is danger of death from a general anesthetic.

A certain degree of cardiac hypertrophy and degeneration goes with every case of chronic Bright's disease, but does not, in itself, constitute a contraindication.

Indeed in several of Edebohls's cases cardiac hypertrophy disappeared after decapsulation.

When, however, the cardiac and the vascular changes have very extensively advanced, the dangers of the operation are so greatly increased that it is not worth the patient's while to take the risk.

When *retinitis albuminurica* is present it shows that extensive vascular changes have taken place through the body, which in themselves will prove fatal in a short time, even though the kidney function be restored.

In 67 per cent of the cases the patients will die in a year, while of the remainder none will survive over the second year.

Guiteras also looks unfavorably upon patients who are suffering from general anasarca with a bad heart, for statistics show that 50 per cent die after operation, 25 per cent are improved and finally die, and only 25 per cent are improved or cured.

Chronic diffuse nephritis is the most unfavorable form of operation as 75 per cent of these die.

Many of them were suffering from general anasarca, nearly all were uremic, and most of them edematous.

## Technic of Operation

It is always advisable for the patient to rest in bed for a week before the operation, as the heart is usually diseased in cases of chronic Bright's disease, and, favoring the organ improves its condition. Rest in bed also lessens the amount of waste material for the kidneys to excrete, and the time can be utilized for the chemical and microscopic examinations of the urine, for regulation of the food and drink, for administering urotropin, and cardiac and vascular regulators, like strychnine, digitalis, nitroglycerin, etc.

The proper preliminary preparation of a patient adds materially to the chances of a successful result.

In the less advanced cases catheterization of the ureters or segregation of the urine, should always be employed, to determine if the disease is unilateral or not.

The operation of *excision of the renal capsule* is performed as follows:

The patient lies prone on the table, with Edebohls's kidney air-cushion underlying and supporting the abdomen. Both kidneys are thus rendered accessible, without changing the position of the patient.

The incision is made from the twelfth rib to the crest of the ilium, along the outer margin of the erector spinæ, without opening the sheath of the muscle. The perirenal fat is exposed and separated from the kidney. The kidney is then lifted out of its fatty bed and delivered through the wound.

The capsule proper is then divided in a direction around the entire convex border of the kidney, each half of the capsule is stripped from the kidney and reflected toward the pelvis, until the surface of the kidney is raw and denuded.

The stripped-off capsule is next cut away and entirely removed. The kidney is then dropped back into its fatty bed, and the incision is closed without drainage. If the kidney was movable before the operation, it should be anchored with sutures to the muscles of the back but this procedure is only necessary when it was movable.

For an anesthetic, Edebohls uses ether, preceded by nitrous oxide; and in cases where Bright's disease is far advanced, he suggests the use of spinal anesthesia with cocaine.

## Results of Operation

Guiteras[15] collected statistics of 150 cases operated upon by various surgeons. He found of these, 16 per cent were cured, 40 per cent improved, 11 per cent unimproved, and 33 per cent died.

In cases of interstitial nephritis, Guiteras states that the results often appear brilliant, as the albumin and casts disappear from the urine, but the amount of solids excreted remains the same.

The mortality in chronic interstitial nephritis was 26 per cent, in chronic parenchymatous, 25 per cent, and in chronic diffuse, 75 per cent.

Death was occasioned by the following causes: exhaustion, uremia, coma, edema of the lungs, acute dilatation of the heart, asthenia apoplexy, and exacerbation of chronic nephritis.

Edebohls[16, 17] sums up the results in 72 cases which he operated upon within the past twelve years as follows: 68 operations on both kidneys, and 4 operations on one kidney only. Seven patients died within two weeks following operation, 13 died ultimately of chronic nephritis or its complications, and 9 died of causes other than nephritis. Three patients were unimproved; 20 are in various stages of satisfactory improvement and progress toward health, at periods varying from two months to twelve months after operation. The urine of several of these is free from albumin and casts.

Seventeen patients were cured of chronic Bright's disease and remained cured at periods after operation varying from one year and nine months to twelve years.

Three patients disappeared and could not be traced.

Since Edebohls's first publications the operation has been tried out by various surgeons pretty thoroughly and has been almost abandoned. It has, however, a limited field of usefulness, which is well summarized by Lehman[18] as follows:

**Indications for Renal Decapsulation.**—Lehman concludes that Edebohls's operation is built up on false premises which are not confirmed in practice and that in consequence it should be rejected outright. This, however, refers only to the operative cure of chronic nephritis. In itself it is justifiable because under certain circumstances it can prolong the life of a nephritic, even though there is no essential curative element in it. Further, decapsulation has an indication in so-called nephralgias and nephrorrhagias of angioneurotic origin. It is an emergency life-saving procedure in extreme oliguria, especially in the uremia of acute nephritis. It also facilitates permanent recovery from the latter, and perhaps may actually contribute to it in some cases. In the uremia of chronic nephritis the operation is only justifiable if an acute exacerbation has occurred, the kidneys being still able to function. In suppurative pyelonephritis decapsulation may sometimes be conjoined with nephrotomy to favor drainage.

## BIBLIOGRAPHY

[1] Harrison, R.: Lancet, Jan. 4, 1896; Brit. Med. Jour., Oct. 19, 1901.
[2] Israel: Mitt. a. d. Grenzgeb d. Med. u. Chir., v, 1899.
[3] Israel: Chirurg. Klinik. der Urinen Krankheiten, Berlin, 1901.
[4] Israel: Deutsch. med. Wchnschr., Feb., 1902.
[5] Pousson: Jour. de Med. de Bordeaux, February 2, 1902.
[6] Pousson: Assoc. franc. d'Urol., October, 1901.
[7] Edebohls: Med. News, p. 481, 1899.
[8] Edebohls: Med. Rec., Dec. 21, 1901.
[9] Edebohls: Med. Rec., April 26, 1902.
[10] Edebohls: New York Med. Jour., Philadelphia Med. Jour., consolidated, May 21 and 28, 1904.
[11] Schmitt: Med. Rec., Sept. 13, 1902.
[12] Van Cott and Murray: Med. News, May 21, 1904.
[13] Johnson: Ann. Surg., April, 1903.
[14] Guiteras: New York Med. Jour., May 17, 1902.
[15] Guiteras: New York Med. Jour., Nov. 7 and 14, 1903.
[16] Edebohls: Med. Rec., March 28, 1903.
[17] Edebohls: Surgical Treatment of Bright's Disease, published by Lisiecki, 9 Murray Street, New York, 1904.
[18] Lehman: Berl. klin. Wchnschr., Jan. 22, 1912.

# CHAPTER XXXVII

## DISEASES OF THE TESTICLES

### ECTOPY OF THE TESTICLE

The testicles are developed in the abdominal cavity of the fetus. About the fifth month of fetal life they begin to descend, and pass through the inguinal canal into the scrotum, arriving there about a month before birth. One of these testicles may fail to follow the normal course, and may be retained:

(*a*) In the abdomen (cryptorchism).

(*b*) In the inguinal canal.

(*c*) The testis may take an aberrant course and may be found lodged under the skin of the abdominal wall, the thigh, or perineum.

#### Etiology

The causes which operate to prevent the normal descent of the testis are obscure. It may be accounted for, however, by assuming that the external inguinal ring is of too small a size to allow the testicle to pass through it, or that the vessels accompanying the spermatic cord are too short to allow the cord itself to be stretched sufficiently to allow the testis to reach the bottom of the scrotum. If the testicle is held by a long mesorchium in the abdominal cavity its mobility may be so great that it slips past the opening of the inguinal canal without entering it.

The wearing of a truss, on account of a hernia, in a case where the descent of the testicle has been delayed after birth, will also prevent the testis from arriving at its normal place in the scrotum.

The causes of crurofemoral and perineal ectopy are still more obscure. It is thought, however, that an overdevelopment of certain bands of the gubernaculum will have the effect of drawing the testis to one side and thus occasioning its aberrant course.

#### Results

The results of ectopy are impairment of the growth and development of the testis, so that it remains undersized, but probably possesses the power of forming spermatozoa, unless its structure is

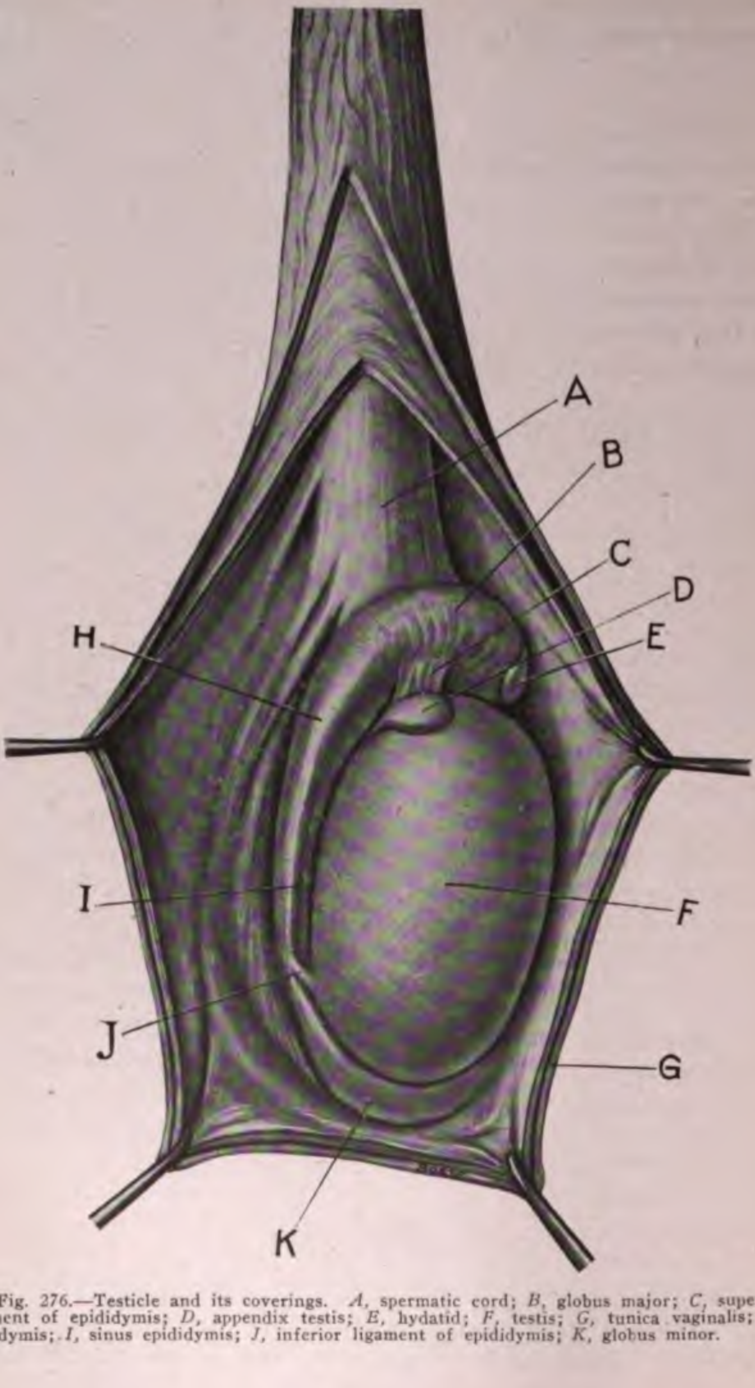

Fig. 276.—Testicle and its coverings. *A*, spermatic cord; *B*, globus major; *C*, superior ligament of epididymis; *D*, appendix testis; *E*, hydatid; *F*, testis; *G*, tunica vaginalis; *H*, epididymis; *I*, sinus epididymis; *J*, inferior ligament of epididymis; *K*, globus minor.

destroyed by attacks of inflammation, which are very liable to occur. After the testicle has been disorganized *sterility,* of course, follows.

## Complications

Hernia is a very frequent accompaniment, and if the testicle lies in the inguinal canal it interferes with the wearing of a truss, so that strangulation of the hernia is very liable to occur.

The testicle when not lying protected by the thighs, in the scrotum, is very liable to be struck and bruised, and the ectopic testicle rarely escapes several attacks of traumatic inflammation.

It is also subject to gonorrheal inflammation from extension of a gonorrhea from the posterior urethra.

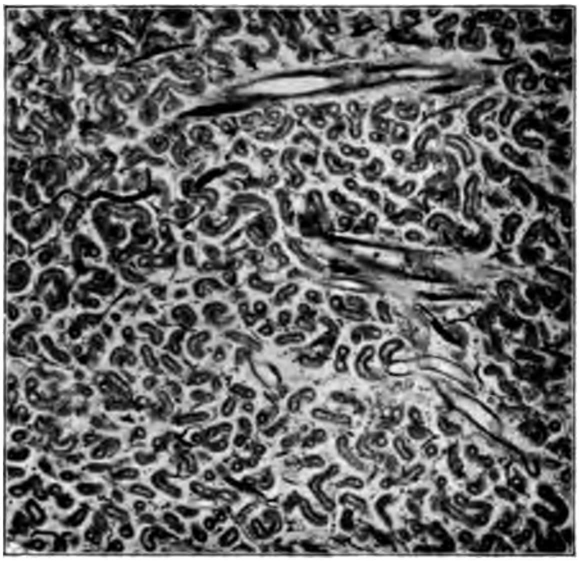

Fig. 277.—Normal testis.

Malignant disease is very apt to occur in the ectopic testicle, and is predisposed to by the attacks of inflammation to which the testicle in this situation is so liable.

## Diagnosis

The diagnosis is made by (*a*) the absence of the testicle from the scrotum; (*b*) the detection of a smooth, oval, soft tumor in the inguinal canal, which moves up and down when the patient coughs and strains.

The testicle should not be mistaken for a hernia, which often complicates this condition.

### Treatment

In *intraabdominal ectopy*, or cryptorchism, it is impossible to rectify the condition by operation, as the spermatic cord is too short to admit of placing the testis in the scrotum.

In addition, as the testicle is protected from traumatism, inflammation does not occur in it, and the dangers of destruction of its function, with consequent sterility or malignant degeneration, do not occur, and the chief reasons for operation do not exist.

In *inguinal retention* it is often possible by means of gentle manipulation to push the testicle into its proper place in the scrotum, and it may be retained in position by wearing a proper truss, which closes the ring and prevents its return.

If this procedure fails to retain the testicle in place, and the child is over six years of age, a surgical operation should be performed, for the reason that the testicle does not reach its full size and functional development while in an abnormal situation. From its exposed location it is also constantly liable to blows and injuries. These lead to repeated attacks of inflammation, causing sterility, and also predispose to malignant disease. A simple and effective operation for replacing the testicle in position in the scrotum and retaining it there consists in making an incision through the scrotum and exposing the testicle, and dividing the fibers of the cremaster muscle. After the muscular fibers have been cut the testicle can be replaced at the bottom of the scrotum and kept from drawing up again into the inguinal canal by a catgut suture passed through the lowest part of the testicle and skin at the bottom of the scrotum. This serves to anchor the testicle and hold it in place.

It is often necessary to bore a cavity in the cellular tissue of the scrotum, with the finger as a bed to receive and hold the replaced testicle. The wound is then closed.

In the author's hands this operation has proved successful and offered permanent relief.

In exceptional cases a different plan may have to be followed. The operation devised by Bevan is at present often employed. The *technic of Bevan's operation* as described by him is as follows:

An incision is made three inches long over the inguinal canal and through the aponeurosis of the external oblique. Under the external oblique will be found a pouch of peritoneum extending from the abdominal peritoneum through the canal and down to the scrotum. This pouch of peritoneum is covered by the cremasteric muscle and fascia and the transversalis fascia. These three layers are divided and the peritoneal pouch opened. The vaginal process of peritoneum should be divided transversely well above the testicle. Care should be taken not to injure the cord, and in children, where the peritoneal process is as delicate as tissue paper, the dissection must be made with great care and with small instruments. After complete transverse division of the vaginal process the upper end is closed with a catgut ligature, as in the sac in a hernia operation, and the lower end is closed with a purse-string suture, making a tunica vaginalis for the testis. Then, with a gauze sponge, the peritoneum is carefully wiped off from the cord. As the wiping proceeds, the cord will gradually lengthen until the testicle can be brought well down upon the thigh. Tense fibrous strands in the cord are to be torn either with the fingers or blunt dissecting forceps, and the cord is to be freed from everything except the vas and vessels. When, as in the exceptional case, a large peritoneal pouch extends to the bottom of the scrotum, the testicle can now be pushed into this and retained by a purse-string suture within the neck of the scrotum. As a rule, however, it is necessary to make a cavity by blunt dissection with the fingers.

In a few cases, but these are exceptional, it is found, even after the free exposure of the cord, that it is not long enough to permit of the reduction well into the scrotum. In such cases it will be seen that the shortened structures are the spermatic artery and veins. These can be divided between two ligatures, care being taken to avoid injury to the vas and the vessels of the vas. It will then be found that the testicle can by gentle traction be brought down sufficiently to replace it in the scrotum without tension. It will be found that the artery of the vas and the veins of the vas are quite sufficient to supply the entire testicle after the ligation of the spermatic artery and anterior group of veins. This statement of Bevan's apropos of the blood supply has been borne out by Moschcowitz in a series of some 20 cases.

The wound is then closed as in an ordinary hernia operation, not transplanting the cord as is done in the Bassini operation, but allowing it to remain in its normal position.

The selection of this operation will depend upon the history of the case.

An operation to replace the testicle in the scrotum is only advisable *before* the occurrence of attacks of inflammation. After attacks of inflammation have occurred, the secreting structure of the testicle is destroyed, and the organ is rendered useless and only liable to disease. On this account *castration* is indicated, and at the same time the inguinal canal may be examined, and, if hernia is also present, it may be radically cured and the canal closed.

## MALIGNANT DISEASE OF THE TESTICLE

It is difficult to draw a distinction between benign and malignant growths of the testicle, because histologically the tumors are nearly always mixed formations composed of fibrous, myxomatous, sarcomatous, and cartilaginous elements associated together, and tumors of the testicle which are apparently innocent are often followed by secondary deposits in the adjacent lymphatic glands and other organs.

### Varieties and Classification

Sarcoma may be composed of spindle or round cells, or may, in its early stages, appear as numerous small cysts, filled with clear or dark fluid, scattered through the substance of the gland.

Carcinoma is usually of the soft, or encephaloid, variety.

Lymphadenoma, chondroma, fibroma, myxoma, and osteoma are also occasionally met.

**The clinical history of sarcoma and carcinoma,** which are by far the most common forms, may be considered together.

The *age* at which the disease usually appears is from fifteen to forty-five years, but sarcoma is occasionally found in very young children.

The disease begins in the glandular epithelium of the tubes or in the connective tissue between the tubes, and increases in size, involving the whole of the body of the testicle.

The tumor formed is smooth and uniform, until the tunica albuginea breaks down, and after this occurs the growth feels irregular or nodular, with areas which are soft and fluctuating. The tumor increases more rapidly in size after rupture of the tunica albuginea and often becomes enormous. The skin of the scrotum sloughs and allows part of the testicle and granulations to protrude through the opening, forming *fungus testis.*

The spermatic cord enlarges from the infiltration of its tissues by the new growth, and the adjacent lymphatic glands become infected and enlarged.

The veins of the scrotum swell, and the lower extremities become edematous from the pressure of the pelvic and lumbar glands upon the iliac veins.

The general health fails, the patient becomes cachectic and emaciated, and death results in one or two years after the first appearance of the growth.

### Prognosis and Treatment

The great majority of tumors of the testicle are either malignant, tuberculous or syphilitic, and it is always desirable to try the effect of inunctions of mercury and large doses of iodide of potassium, for ten days, if there is any suspicion of syphilis, or have a Wassermann test made. If there is no improvement at the end of that time, *castration* should at once be performed.

If this is done early enough, the disease may be permanently cured, but unfortunately it is not uncommon for the lymphatic glands in the pelvis to be involved, and a recurrence of the disease often takes place within a year after the operation.

# CHAPTER XXXVIII

## DISEASES OF THE TESTICLES (Cont'd)

## TUBERCULOSIS OF THE TESTICLE AND EPIDIDYMIS

The testicle is frequently the seat of tuberculosis, which always begins in the epididymis and may subsequently involve the body of the testicle.

The epididymis may be affected (*a*) primarily, which is most frequent; (*b*) secondarily from a tuberculous deposit in one of the other genitourinary organs, or (*c*) in consequence of a general tuberculosis.

### Channels through Which Tubercle Bacilli Are Conveyed to the Epididymis

When the epididymis is affected primarily, the bacilli are introduced into the general blood circulation and carried directly to the epididymis by the spermatic artery.

When the infection in the epididymis is secondary it is frequently derived from the seminal vesicles or prostate. These are often affected by tuberculosis, as the result of tubercle bacilli which were introduced into the urethra during coitus.

After the tuberculous process is established in the vesicles, the bacilli are carried along the vas deferens and lodge in the epididymis.

If the tuberculosis in the epididymis is derived from the bladder, prostate, or other adjacent organs, the infection is usually carried by means of the lymphatics.

There are certain *predisposing causes* to tuberculous infection such as a hereditary tendency to consumption and such local causes as the prolonged congestion from erotic excitement, an attack of gonorrhea, or slight traumatism. These causes all probably operate in the same way, by lowering the resistance of the tissues and permitting the tubercle bacilli to take effect.

The time of life at which the testicle is most likely to be attacked is during its period of activity, from the age of puberty until past the fiftieth year.

### Course

One or two small nodules form in the head of the epididymis. Occasionally they remain latent for years or may become encapsulated and converted into fibrous tissue. As a rule, however, the nodules grow and coalesce until the whole epididymis is so much enlarged that it surrounds the testicle. After a time the tuberculous mass softens, becomes cheesy, and breaks down.

The skin of the scrotum lying over the nodules is attached to the testicle, glued fast by the inflammatory adhesions, and the pus is discharged through an opening in it from the tuberculous abscess, leaving a fistula.

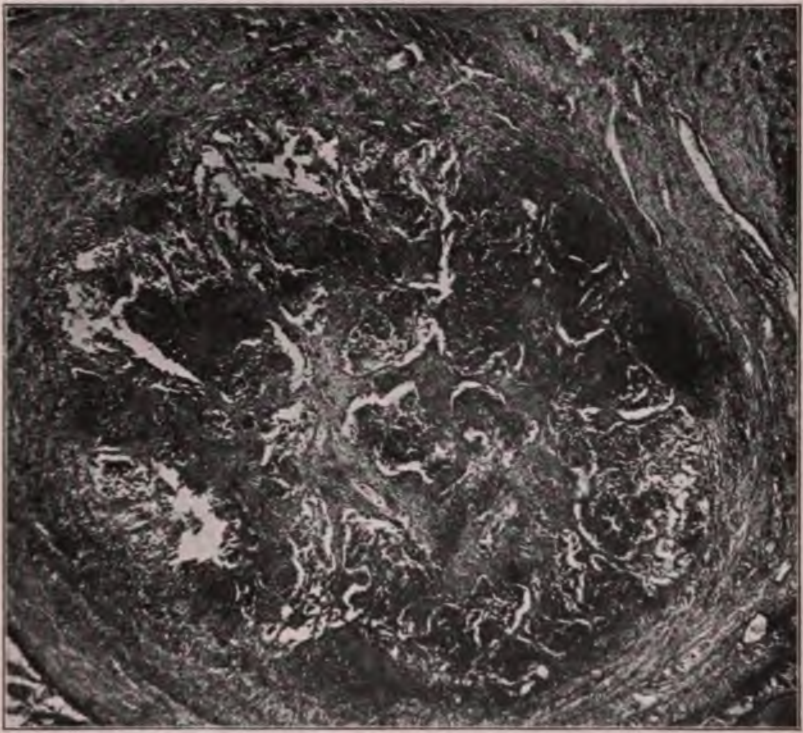

Fig. 278.—Tuberculous epididymitis; cheesy nodules.

The disease seldom limits itself to the epididymis, but if left alone spreads to the testicle. This occurs in three-fourths of the cases, as shown by autopsy.

After the abscess in the epididymis or testicle has opened, a considerable amount of attached skin lying over the nodule may slough away, leaving an opening in the scrotum through which a mass of new granulation tissue, growing from the testicle or tunica albuginea, may protrude, forming *hernia testis*, or *fungus testis*.

In the earlier stages of the disease, before abscess formation, the *tunica vaginalis* is affected by the inflammation, and, if an excess fluid is secreted by its walls, hydrocele may be present.

On the other hand, adhesive inflammation may take place, a the sac of the tunica vaginalis become obliterated.

Occasionally purulent collections containing tubercle bacilli found in small cavities, circumscribed by the adhesions.

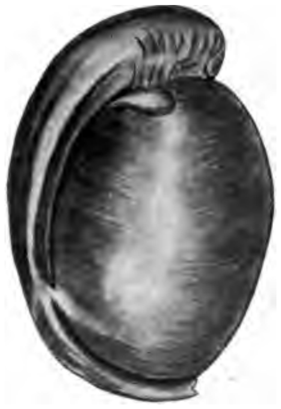

Fig. 279.—Normal testicle and epididymis.

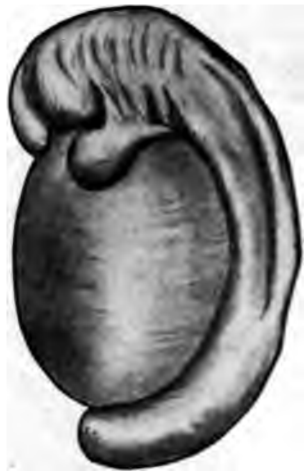

Fig. 280.—Epididymis enlarged and rounding body of the testicle.

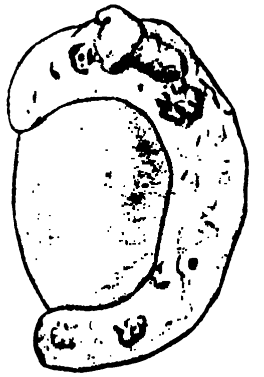

Fig. 281.—Tuberculosis of the epididymis. Body of the testicle free from involvement. Epididymectomy operation of choice.

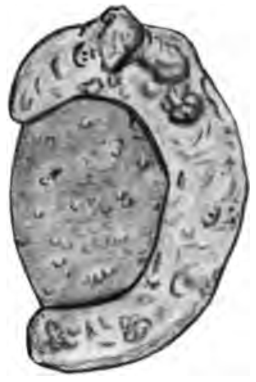

Fig. 282.—Tuberculosis of the epidid and body of the testicle, demanding ca tion.

The *vas deferens* is always affected in time, and shows small loc ized nodules in its continuity, which are most liable to be located its extremities,—i.e., near the seminal vesicle and the epididymis the intermediate portion being free.

Discomfort does not occur until inflammation begins, with its pain, swelling, and subsequent abscess formation.

In the early stages examination shows one or more small nodules of a peculiar stony hardness to touch, located in the head of the epididymis and along the cord.

Later in the disease, after the nodules have become cheesy or broken down, the skin is found to be adherent over a circumscribed tumor, with hard walls and a central softening, which may yield fluctuation if pus is present.

Although the nodule may be actually located in the epididymis, the enlargement of this part of the organ is so great that it may surround the body of the testicle, giving rise to an appearance as though the nodule were in the testicle itself.

Suspicions as to the tuberculous nature of a growth should always be aroused by the history of an epididymitis coming on without any apparent cause or after a slight injury, and in perhaps half of the cases of tuberculous epididymitis an examination of the prostate and seminal vesicles through the rectum will disclose the characteristic small, hard nodules which verify the diagnosis.

If the accompanying hydrocele is considerable in size, the fluid should be drawn off, so that the outline of the testicle may be more clearly felt on palpation, and occasionally, though not often, tubercle bacilli may be found on microscopic examination of the aspirated fluid. The tests for the tuberculin reaction may be employed in making the differential diagnosis. The von Pirquet test is simpler to use, but, as nearly every adult has a focus of healed tuberculosis in his body, a positive reaction is not an absolute proof. The subcutaneous injection of old tuberculin with its accompanying temperature rise in the presence of an active focus of tuberculosis is more reliable.

Under treatment the severe inflammatory symptoms of epididymitis quickly subside, and are usually followed by a general softening of the tumor and formation of abscess, differing in this way from the simple epididymitis, which, after it is over, leaves a hard and thickened epididymis.

## Prognosis

It is a very rare occurrence for tuberculosis of the testicle to become permanently cured without operation, even under the most favorable climatic influences.

When a cure does occur, it is through a process of encapsulation and fibroid degeneration, but it often happens that the process of encapsulation only closes up the infective material for a time. and under favoring conditions the deposit again becomes active and continues its usual course of caseation, abscess formation, and infection of remote organs.

Tuberculous nodules, however, may remain latent for many years before abscess forms, or until a slight traumatism or attack of gonorrhea stirs them into activity.

After suppuration the disease runs a rapid course, and leads to a fatal termination, either by inducing tuberculosis in some other organ or by exhaustion and fever incident to the occurrence of suppurating fistulæ.

### Treatment

Palliative measures are, unfortunately, only applicable to people of means, who are able to lead an out-of-door life or take a long sea-voyage, and who can have constant medical supervision. Such measures may retard the caseation of the nodules if begun in the earliest stage while the deposits are small and hard.

As soon as the deposits begin to soften and become cheesy, surgical measures should at once be resorted to, as waiting for resolution, which never occurs, is only a waste of valuable time, and allows the extension of the disease to remote organs.

In the case of hospital patients who are poorly nourished and badly housed, and who can not have suitable climatic surroundings, the nodules should be removed at once.

### Operative Treatment

**Erasion,** or **curetting,** is the operation which is sometimes advised in the cases where one or two small nodules exist in the epididymis. The softened area should be opened and the contents well scraped out with a sharp spoon, iodoform rubbed in, and the cavity packed and allowed to heal by granulation.

Erasion has never been very extensively employed, on account of the fact that tuberculous nodules so small as not to be recognized are generally present in the body of the testicle and relapses are pretty sure to occur.

### Epididymectomy

Where only one or two distinct nodules are felt in the epididymis and the testicle appears healthy, epididymectomy is the operation advised at the present time. The testicle and epididymis are exposed by incision through the scrotum; the epididymis with the tuberc nodules is dissected away from the testicle and extirpated, and the severed end of the vas deferens is sewed into the wound, so that any tuberculous material in its peripheral part and the seminal vesicle has an exit and is not discharged in the wound. Rovsing reports 27 cases treated in this way with good results.

**Castration** is the operation best adapted to the advanced cases. The indications for its use have been summarized by Jacobson as follows:

(*a*) When erasion has failed in lesions of the epididymis.

(*b*) When discharging fistulæ are present or are numerous.

(*c*) When, after erasion, persistent swelling of the testicle accompanied with night sweats and loss of flesh is present.

(*d*) When fungus testis exists or when the body of the testicle is involved.

(*e*) In the presence of purulent hydrocele.

Castration is used in two different classes of cases:

*Class A.*—In *primary* tuberculosis, when the disease is limited to one testicle and has not extended too high along the cord, and when the bladder, prostate, and vesicles are not affected. In such a case a reasonable hope may be entertained that the disease may be permanently eradicated from the body. If the seminal vesicles are affected the indication for castration is not so clear, although, if the deposits are small and of recent date and the patient's general condition favors rapid healing, removing the testicle with its diseased nodules may retard the development of the tuberculous foci located elsewhere.

*Class B.*—In cases where other organs of the body are tuberculous and a cure is impossible, hygienic measures alone are the only treatment applicable. An exception should be made to this rule when the testicle is disorganized and the scrotum riddled with sinuses discharging pus. Here castration is indicated to relieve the patient from the drain of the exhausting discharges and from one source of his discomfort.

In the operation of castration the infiltrated skin and the cellular tissue should be removed, and if nodules are found in the spermatic cord it should be divided as high up as possible by burning the vas deferens through with the Paquelin cautery and ligating the vein and artery.

If the cord is not infiltrated it is better to separate the vas deferens from the vessels and bring the end out of the wound as described in the operation of epididymectomy.

### Tuberculin

The use of tuberculin is now generally advised in cases of tuberculosis of the epididymis after surgical procedures have eradicated as much of the disease as is possible, but it should not be depended upon to take the place of radical treatment.

After every surgical procedure it is essential for the patient in order to prevent recurrences to live an out-of-door life and remember that he is still a tuberculous subject.

### Syphilis of the Testicle

The testicle is attacked by syphilis in the late secondary and tertiary periods, which presents itself in **two forms:**

(*a*) **Interstitial or diffuse form** consists in an infiltration of the connective tissue between the tubules, which becomes converted into a hard, fibrous induration, compressing and destroying the tubules, and an atrophy of the entire organ results.

(*b*) **Circumscribed or gummatous form** is a deposit of gummatous nodules varying in size from a pinhead to a hen's egg. After they have enlarged to a considerable size the mechanical compression of the cortex causes a cheesy degeneration of the substance and a contraction of the nodule, or the center becomes softened and is discharged through an ulcerated opening in the skin of the scrotum.

The epididymis may be involved secondarily in both forms, and hydrocele usually occurs from an effusion of fluid into the sac of the tunica vaginalis.

### Symptoms and Course

The body of the testicle enlarges slowly and insidiously, without causing any pain, and it often becomes as large as an orange.

In *shape* its outline is regular, although the protuberance of a circumscribed gumma may sometimes be felt. Its consistence is dense, and it feels heavy. The spermatic cord, as a rule, is not thickened.

The scrotum is not affected until after the gumma breaks down, when it becomes adherent, inflames, and ulcerates, and *fungus testis* forms.

The disease is seldom bilateral at the beginning, but the other testicle may be attacked later.

Sterility only results from advanced disease in both organs, as a part of the secreting substance of the gland is spared.

## Diagnosis

Syphilitic testicle is liable to be mistaken for tuberculosis, neoplasms, gonorrheal epididymitis, or hematocele.

The distinguishing points in syphilis are the regular outline and smooth, hard surface and the fact that the cord is not enlarged, and in addition the history of a past attack of syphilis and a positive Wassermann reaction.

The diagnosis may be confirmed by the effects of antisyphilitic treatment, and this should be tried in every case of tumor of the testicle before proceeding to operation, if there is the slightest question of a previous syphilitic infection.

## Prognosis

Under appropriate treatment syphilitic infiltration is absorbed, and it is surprising to note how quickly large swellings disappear and the function of the testicle is restored.

In untreated persons—particularly in tuberculous, alcoholic, and weakly individuals—the gummata break down and discharge and hernia testis follows, but even neglected cases which present ulceration of the scrotum and large fungus testis generally heal in from four to six weeks under antisyphilitic treatment.

## Treatment

The treatment consists in an intensive course of salvarsan followed by a general course of mercurial inunctions and the internal administration of iodide of potassium in increasing doses running it up to ½ ounce per day, if necessary, to cause absorption of the newly formed tissue.

### BIBLIOGRAPHY

Barney, J. D.: Jour. Urol., 1911; Boston Med. and Surg. Jour., June 19, 1913.
Jacobson: Dis. Male Organs of Generation, 1893.
Plaggemeyer, H. W.: Urol. and Cut Rev., 1916, No. 3.
Rovsing: Ztschr. f. Urol., iii, No. 4.
Walker, Thompson: Diseases of the Genitourinary Organs, 1914.

# CHAPTER XXXIX

# HYDROCELE, HEMATOCELE, AND VARICOCELE

## HYDROCELE

Before the testicle descends from the abdominal cavity in the fetus, it is preceded by a process of peritoneum, which makes its way through the inguinal canal and forms a pouch in the scrotum called the *tunica vaginalis testis.* After the testicle has descended it lies *behind* the pouch, and is adherent to it.

Under ordinary conditions the opening in the pouch which formerly communicated with the abdominal cavity is closed. If it remains open, *congenital hydrocele* is said to exist. If the opening closes, the testicle is provided with a shut sac, lying in front of it and partly surrounding it, which serves as a protection against injuries, and allows of a certain freedom of motion.

## ACUTE HYDROCELE

### Etiology

Acute hydrocele is usually the result of a contusion of the testicle or a punctured wound of the sac of the tunica vaginalis. It may also occur from an extension of inflammation from the epididymis or testicle, occurring in the course of gonorrhea or other infectious disease.

### Pathology

Its pathology consists in an accumulation of serous fluid, which is occasionally stained with blood in the sac, and a deposit of lymph upon its walls.

### Symptoms

The symptoms consist in edema and redness of the scrotum, accompanied by an elastic painful swelling, which is tender on pressure over the testicle.

If much fibrin is deposited, crepitation is sometimes observed. Acute hydrocele *terminates* either (*a*) in recovery in two or three weeks, with the formation of adhesions within the sac and a thickening of its walls; (*b*) in suppuration or (*c*) it may become

### Treatment

The treatment consists in rest, with suspension of the scrotum and the local use of an ice bag or hot application. After the acute symptoms have subsided the patient can walk about, wearing a suspensory bandage. If much fluid is present in the sac and tension is extreme, aspiration is required.

## ACUTE PURULENT HYDROCELE

It occasionally happens that a fibroserous hydrocele becomes purulent instead of resolving, or suppuration may occur early as a result of an infected puncture of the sac, or an extension of a suppurative process from the testicle or epididymis.

In such a case the contents of the sac, instead of being clear serum, are composed of pus. Such a condition is apt to result in involvement of the peritoneum or a general septic infection, unless the pus is evacuated by a free incision and drainage.

## CHRONIC HYDROCELE

Chronic hydrocele is generally confined to one side, and ordinarily occurs between the twentieth and fortieth years, although children are occasionally born with it. It generally begins insidiously, although it may follow an acute attack.

It is supposed to be a mere passive process of transudation dependent upon the state of the blood vessels and circulation, when it occurs as a primary disease.

### Pathology

The quantity of fluid which the sac contains is variable, from a few ounces to 1, 2, or even 3 quarts. Its color is usually clear and watery, but it may be greenish or bloody. It contains a large number of desquamated epithelial cells and leucocytes, it appears turbid, and blood gives it a reddish or brown color.

In rare cases the fluid is white, and resembles milk, from an admixture with lymph (hydrocele chylosa), and, in the tropics and in cases of true elephantiasis, filaria are found in the milk-like contents of the sac.

In long-standing cases of chronic hydrocele the tunica vaginalis is thickened, and may be calcified in portions, and the testicle and epididymis are hard and atrophied.

Sometimes adhesions form, and the sac is converted into a number of distinct compartments. In other cases small fibrous or fibrocystic bodies are attached to the wall or lie loosely within the sac.

### Symptoms and Diagnosis

Hydrocele causes no symptoms except those which arise from the increase in size and weight of the scrotal enlargement.

On palpation, the tumor is found to be pear-shaped and elastic to the touch, dull on percussion, without impulse on coughing, and it can not be reduced and returned into the abdomen.

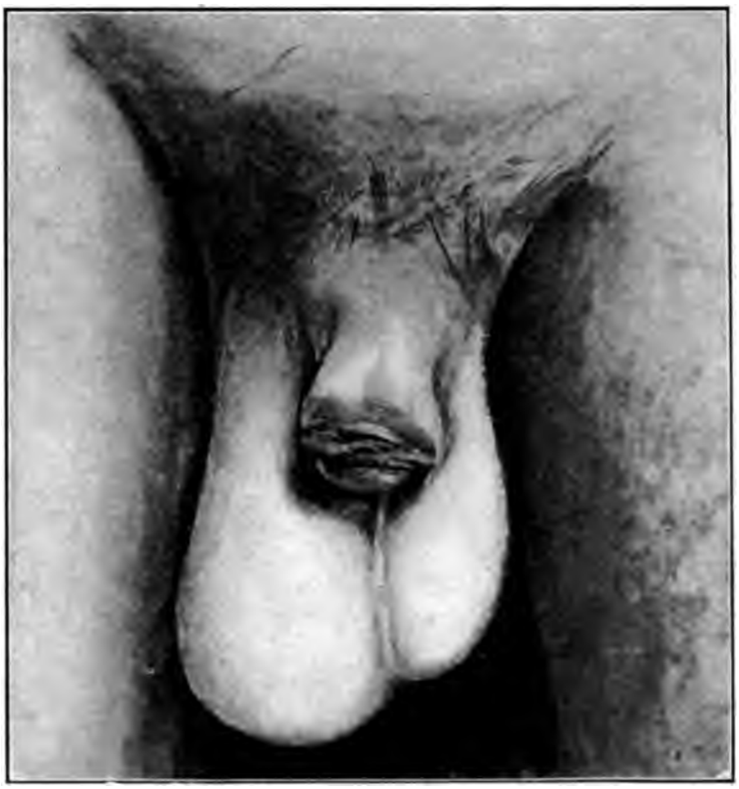

Fig. 284.—Hydrocele. (Author's case, Kings County Hospital.)

Attention to these points will usually differentiate a hydrocele from a hernia, hematocele, neoplasm of the testicle, or a hydrocele of the cord.

An additional point in diagnosis is the *translucency* of cele when it is viewed through a tube with a candle placed on the other side of the scrotum.

Instead of using a candle, an electric hand-searchlight affords a convenient means of examining the hydrocele for the sign of translucency, and by moving the light over the surface of the tumor the outline of the testicle itself can often be made out.

This sign is not infallible, however, as the thickened walls of the sac or turbidity of its contents from pus or blood prevent the light from being transmitted.

As a last resource in diagnosis a suspected hydrocele may be aspirated with a fine needle, or the patient may be prepared for operation and the contents of the scrotum exposed by incision.

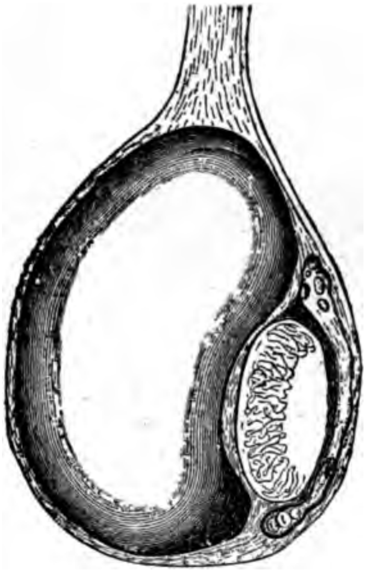

Fig. 285.—Vertical section of simple hydrocele.

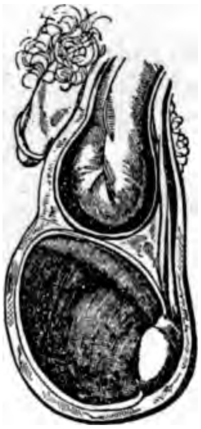

Fig. 286.—Hydrocele complicated by hernia.

## Treatment

The spontaneous healing of a hydrocele in an adult is such a rare occurrence that operation is always called for.

**Puncture** with a trocar may be regarded as palliative only, for the sac always fills up again with fluid in a short time.

*Technic.*—The scrotum is grasped in the hand and made tense, and after locating the position of the testicle, which is usually a little below and lying behind the sac, the trocar, with its point directed obliquely upward and inward, is thrust into the swelling, and the fluid is withdrawn.

**Radical Treatment by Injection.**—This is successful in many cases of hydrocele of moderate size and where the walls of the sac are not thickened, although it is more liable to be followed by a relapse than after incision.

The advantages of injection are, that no anesthetic is required and the patient is only confined to the house three or four days.

*Technic.*—A hypodermic syringe is filled with 5 to 20 minims of pure carbolic acid, and the needle is introduced into the cavity of the sac. The hydrocele is then tapped with a trocar in the ordinary way, and the fluid is drawn off entirely. It is necessary that the sac should be completely emptied, for, if fluid is left in, the carbolic acid is diluted, so that it does not produce the necessary amount of irritation, and if diluted it may be absorbed and cause poisoning.

Fig. 287.—Electric hand-searchlight.

After the fluid is drawn off, the carbolic acid should be injected, through the hypodermic needle, which has remained *in situ,* and the carbolic acid is not withdrawn, but left in the sac. Inflammatory reaction is excited, but the exudate is gradually absorbed, and the sac becomes obliterated by the formation of adhesions between its visceral and parietal walls.

**Incision of the sac** is preferred to the treatment by injection in the following cases (Morris):

I. When the sac is very thick, opaque, cartilaginous, or calcified.

II. If doubt exists as to whether the hydrocele is congenital or is a hydrocele of a hernical sac with a small opening into the peritoneum.

III. When a hernia complicates hydrocele and a radical cure of both is desired.

IV. When a loose or pedunculated fibrous body is present in the tunica vaginalis.

V. When organic disease of the testicle is suspected.

VI. When on account of ill health or lessened resistance the risk of inflammation after injection is especially to be dreaded.

There are three methods of performing the operation of incision:

(*a*) *Volkmann's Operation of Simple Incision.*—In this procedure the sac is opened by a longitudinal incision through the scrotum, and after the fluid is evacuated the edges of the walls of the sac are stitched to the edges of the wound in the skin, to prevent leakage into the cellular tissue of the scrotum. The cavity of the sac is packed and allowed to heal by granulation, and in this way the sac becomes obliterated. The patient is able to get out of bed in a week, and the wound is healed by about the third week.

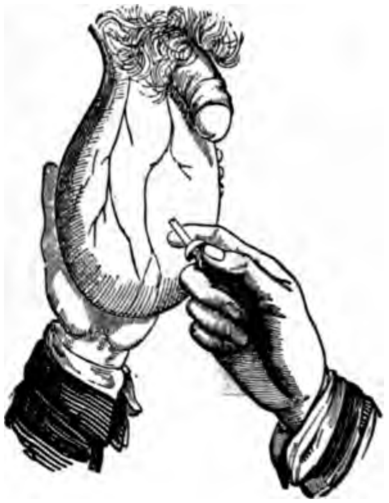

Fig. 288.- Tapping a hydrocele.

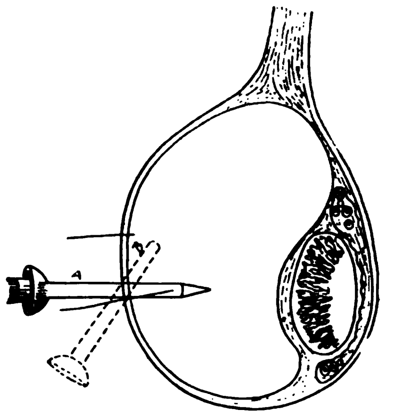

Fig. 289.—Tapping a hydrocele. *A*, direction of trocar at time of puncture; *B*, direction of trocar by evacuation.

(*b*) *Von Bergmann's Operation of Incision and Excision of the Tunica Vaginalis.*—Tillmanns considers this the best radical operation. The sac is laid bare by a longitudinal incision, and by blunt dissection is freed from the cellular tissue. The redundant portion of the sac is then cut away with scissors from the testicle, but leaving enough of the wall of the sac to cover the testicle itself. The external wound is closed with sutures, and a dressing applied which will exert compression. The wound is cicatrized in from eight to twelve days. Relapses are more certainly prevented through excision than by other methods, and the wound heals in a very short time.

(*c*) *Doyen's Operation of Incision and Excision of the Sac.*—An excellent operative procedure recently suggested by Doyen for thin-walled hydroceles consists in incising the sac and everting the testicle so that it lies outside the sac. The wound in the sac is then sutured to prevent the return of the hydrocele, and the incision in the scrotum is closed without drainage.

The operation of simple incision of the sac is attended by the disadvantage of the prolonged time of convalescence.

Excision of a portion of the sac is sometimes followed by hemorrhage, which is a free and continuous oozing from the cut edge of the sac, and which fills up the cavity of the scrotum, causing a hematuria. The oozing is best controlled by a running catgut suture around the edge of the sac at the time of the operation.

If the portion of the sac wall which contains the nutrient artery is cut away, necrosis of the testicle follows.

Doyen's operation is especially adapted to thin-walled sacs, but may also be used in cases with thick walls, and these disadvantages can be thus obviated.

## HYDROCELE OF THE SPERMATIC CORD

(*a*) **The cystic form** is found as one or more small cysts, which form in the sheath of the cord, along its course between the testicle and the internal ring. The cysts are caused by an infusion of serous fluid into some part of the processus vaginalis, which was not obliterated after the descent of the testicle.

The cysts usually occur between the testicle and internal ring, and may extend so far down into the scrotum as to displace the testicle to one side; in a few cases the cyst lies within the inguinal canal.

Occasionally the cyst forming a hydrocele of the cord is not closed at either end, but communicates with the tunica vaginalis and also the peritoneal cavity (communicating hydrocele of the cord), and it is a frequent occurrence for the cyst to communicate with the sac of the tunica vaginalis testis. The cysts are shaped like an egg, and range in size from a pea to a hen's egg.

(*b*) **The diffuse form** of hydrocele of the cord is of extremely rare occurrence, and consists in an edematous infiltration of the entire sheath of the cord, ceasing abruptly at the testicle below. The chief importance of hydrocele of the cord is from a diagnostic standpoint: in differentiating it from cryptorchism or hernia.

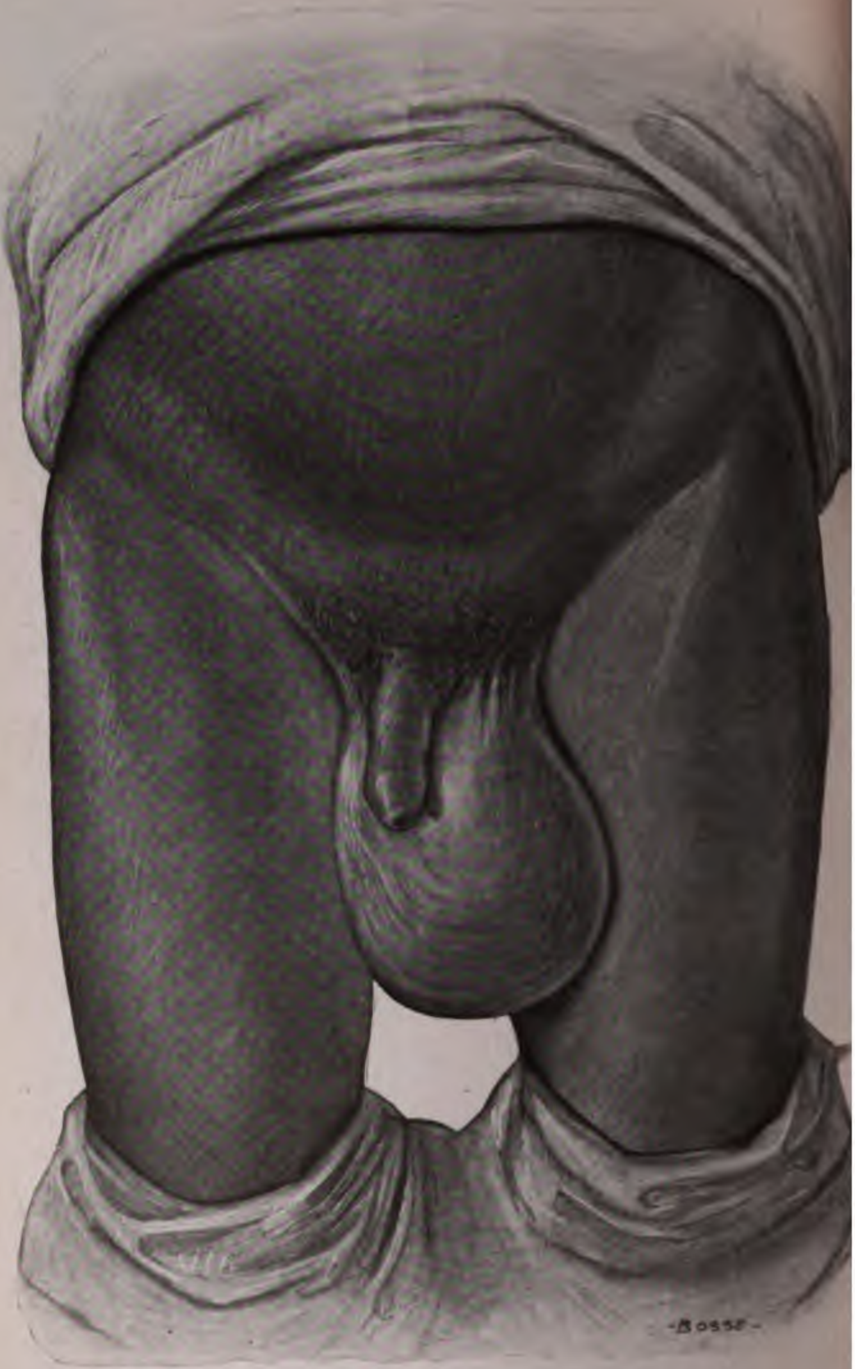

Fig. 290.—Chronic hydrocele complicated by hematocele from a fall. (Author's case.)

### Treatment

The use of injections of carbolic acid is attended with some danger, as the cyst may communicate with the peritoneal cavity and the carbolic acid may flow back into the abdominal cavity.

Operation is usually called for, and consists in division of the common sheath of the cord, in a longitudinal direction, and exsection of as much of the sac as can be separated from the cord. If the sac is found to be open, communicating with the peritoneal cavity, it is necessary to close the inguinal canal by suturing the upper edge to Poupart's ligament, as in Bassini's operation for hernia. If this were not done, the omentum and gut would subsequently descend through the patulous inguinal canal and cause hernia.

## HEMATOCELE

Hematocele is the name given to the tumor which forms when a hemorrhage occurs (*a*) into the sac of the tunica vaginalis (vaginal hematocele), or (*b*) into the scrotal tissues around the testicle (extravaginal hematocele), or (*c*) with the sheath of the spermatic cord (hematocele of the cord).

### Etiology

A *predisposing cause,* in the shape of disease of the walls of the tunica vaginalis or of the testicle, is very apt to be present.

The *exciting cause* of the hemorrhage is always traumatism, which may be slight, such as coughing, sneezing, or straining at stool,—or it may be severe and the result of a blow or kick upon the scrotum or the accidental puncture of the testis with a trocar in tapping a hydrocele.

### Symptoms and Course

Swelling of the scrotum takes place very quickly after the injury, and a tumor forms, which is a hard, smooth, globular swelling surrounding the testicle. After a few days inflammatory thickening of the tissues occurs, and the hematocele is liable to be mistaken for a neoplasm of the testicle.

The blood clot may remain for years without being absorbed, in which case the walls of the tunica vaginalis become thick and dense, and the testicle undergoes atrophy. On the other hand, the clot may become infected, and suppuration occurs, ending in abscess.

### Treatment

In recent cases a moderate effusion of blood may be absorbed with the assistance of rest in bed, elevation of the scrotum, and 25 to 50 per cent ointment of ichthyol; but spontaneous absorption is of seldom occurrence, and operation is usually necessary.

The operative treatment consists in laying open the sac by a free incision and evacuating the blood clot. The sac of the tunica vaginalis may afterward be treated as a hydrocele, and either exsected or its cavity packed and allowed to granulate.

## HEMATOCELE OF THE SPERMATIC CORD

This is a rare affection, and may occur from direct violence or from the strain of lifting a heavy weight, even though the cord is perfectly healthy.

A fusiform swelling rapidly develops along the cord, which is easily mistaken for hernia. After a few hours the swelling becomes hard and tense, with ecchymoses into the surrounding tissues, and the diagnosis is made clear.

The treatment is conducted on the same lines as for hematocele of the tunica vaginalis.

## VARICOCELE

Varicocele is an abnormal dilatation of the veins of the spermatic cord, and is analogous to the varicosities which occur in the veins of the lower extremities.

A slight varicocele often disappears spontaneously after marriage, when sexual intercourse is duly regulated, and also in old age.

### Etiology

The causes of varicocele are, in a general way, those of varicosities elsewhere; prolonged standing, ungratified sexual excitement continued for some time, and constipation, all tend to cause passive congestion and disturbance of the circulation, with increase of hydrostatic pressure in the veins of the cord.

The spermatic veins are more liable to enlarge than others, because their valves are insufficient to uphold the long column of blood, which also derive but little external support from the loose cellular tissue of the scrotum in which they lie.

Billroth believes that there is an inherited predisposition to the formation of varicosities, which is first manifested in the spermatic veins, and later in those of the rectum and legs.

Varicocele occurs most frequently on the left side, because, while the right spermatic vein enters the vena cava at a sharp angle, the left spermatic vein, after passing underneath the sigmoid flexure, empties at a *right angle* into the left renal vein. The pressure exerted by the colon and the right-angled insertion of the vein tend to impede the current of blood, and cause an increase in the hydrostatic pressure, which is greater on the left side than on the right.

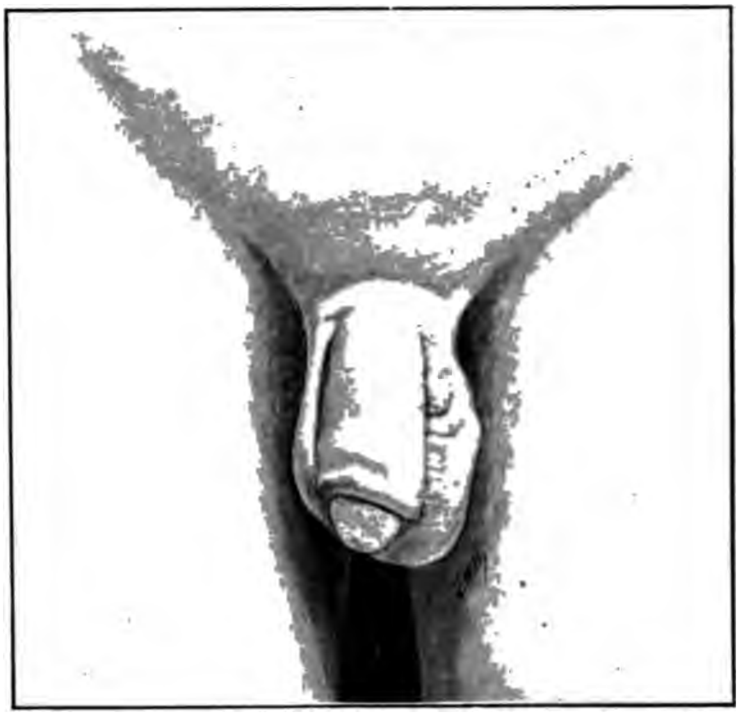

Fig. 291. Varicocele. (Author's case, Kings County Hospital.)

## Symptoms

In robust and vigorous men varicocele of moderate size causes but little discomfort, at most only a sense of weight and dragging in the spermatic cord, after long standing, walking, riding, or any sudden exertion. These things all exaggerate the swelling of the veins and the discomfort from them is always increased toward evening.

In young men who are weak and anemic or who have previously masturbated excessively, a feeling of fullness and burning in the scrotum and cord, accompanied by pains radiating into the abdomen and occasionally marked neuralgia of the testicle, is often met with. Such individuals are frequently sexual hypochondriacs, and suffer from mental depression and the fear of impaired virility, or even impotence, arising from the varicocele. They should be taught to regard the varicocele, if moderate in size, with indifference, as it has a natural tendency to subside as age advances and particularly after the regulated coitus of marriage is instituted.

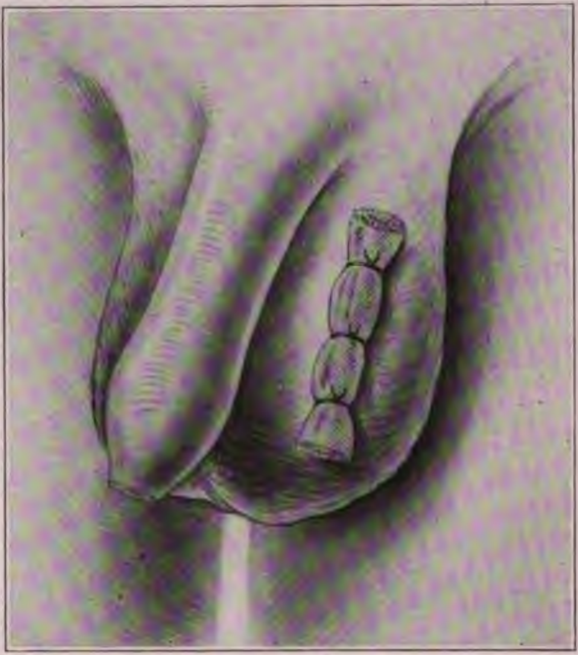

Fig. 292.—Dressing for incision in the scrotum, held in place by tying in with sutures.

It is only in cases of very pronounced varicocele, where the circulation is materially impaired, that serious atrophy of the testicle occurs, although in every case of varicosities of the cord the circulation in the testicle is somewhat interfered with, and it is softer and smaller than normal.

The spermatic vein may become the seat of disease, and in rare cases thrombosis, phlebitis, gangrene, etc., may occur.

## Diagnosis

The diagnosis of varicocele is usually easy, and the veins in the scrotum feel like a bunch of angle worms. In very marked cases the enlarged blue veins can be seen shining through the skin of the scrotum. In cases of moderate severity the testicle is slightly flabby and the skin of the scrotum relaxed.

If the patient lies down, the swelling disappears, not suddenly, like hernia, but more gradually and almost imperceptibly, and, if he stands upright again, pressure with the finger over the external ring does not prevent the veins from refilling with blood, whereas in hernia the omentum is prevented from descending by pressure over the ring.

## Treatment

Palliative treatment is all that is required in varicocele of moderate size and which causes but little discomfort. The scrotum should be supported with a well-fitting suspensory bandage, and, locally, cold douching is of service in giving tone to the muscles. Constipation should be prevented, and the patient should avoid erotic excitement or too frequent coitus.

Operation is required only in marked cases, when the support of a suspensory bandage is not sufficient to remove the annoyance of weight and dragging, after walking or long standing, or in cases where a considerable degree of enlargement of the veins exists. Operation is also called for in persons desiring to enter the army or navy, or police service, in which any degree of varicocele is regarded as a disability.

The operation of **subcutaneous ligation of the veins** is popular with some surgeons. It has the advantage that the time of convalescence is a little shortened, but its disadvantages are weighty. A vein is very liable to be punctured, and an hematocele occurs. The silk ligature remains permanently, becomes imbedded in scar tissue, and sometimes causes persistent neuralgia, making it necessary to open up the wound and exsect the knot, or the knot may slip and the vein is not occluded. The danger of tying in the spermatic cord exists, but can be guarded against by due care in holding the cord out of the way.

Relapses occur with greater frequency after subcutaneous ligation than after excision.

**Excision of a portion of the veins** is the operation to be preferred, and the patient is only kept in bed for a week or ten days. By the open operation it is possible to avoid all the dangers attendant upon the subcutaneous ligation.

**Technic.**—The patient is etherized, and an incision made over the bunch of veins, beginning near the external inguinal ring and extending two inches down over the scrotum. The veins are exposed by dissection and ligated in two places, about an inch apart. The portion of the veins lying between the ligatures is then cut out with scissors, and the cut ends of each portion of the vein are brought together into apposition and held so, by tying the ends of the ligatures together, and in this way the vein is shortened. The wound is then closed by sutures.

The patient is kept in bed for a week, and on a sofa for another week, and after the third week he can begin his active labors, and the same length of time should elapse after the subcutaneous ligation.

After either operation a hard mass remains in the scrotum, composed of coagula in the veins and infiltration around them. This is absorbed and disappears in from two to four months.

Atrophy of the testicle exceptionally follows either operation, even when the cord is not included in the ligature.

On account of the difficulty of securing a thoroughly sterile operation field, among the rugæ of the scrotum, the following plan for excising a varicocele, by which the incision is made above the pubes, is extensively used in the United States Army and elsewhere:[1]

The pubes are shaved and the skin sterilized in the usual way.

The finger is introduced by the spermatic cord into the inguinal canal until the external ring is felt.

An incision is then made corresponding to the axis of the canal, one inch long, the upper end terminating over the external inguinal ring.

Superficial and deep fasciæ are divided over a director. The vessels of the cord then come into view. The finger is passed under the cord by a little blunt separation, and the cord is raised out of the wound. The spermatic cord and artery are returned to the bottom of the wound, to prevent accidental injury. A sound vein, selected for preservation to return the blood from the testicle, is carefully separated from the strand of veins and carried alongside the duct.

The veins are then dissected from the connective tissue for a distance of about two inches, ligated with small-sized catgut at the end of these dissections, and cut off between the ligatures.

The ends of the ligatures are then tied together, thus approximating the upper and lower ends of the veins. For further safety the ends are united by stitches, and finally anchored to the external pillars of the ring.

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[1] Circular No. 3 from Surgeon-General's office, February 27, 1901.

The deep and superficial fasciæ are then separately united with a continuous catgut suture, and the skin by a subcuticular suture of silkworm gut.

This method has been found very successful in preventing infection of the wound, either during the operation or subsequently.

### Diagnosis of Tumors in the Scrotum

Ordinarily the diagnosis of the nature of a tumor in the scrotum can be made without much difficulty. In a few cases, however, it is impossible to make a diagnosis until the scrotum is freely incised and laid open, and the tumor is fully exposed to view.

A methodic examination will facilitate arriving at a correct opinion, and the student may find the following schematic arrangement of use:

We should endeavor to determine if the tumor in the scrotum is an
**Enlargement of** (*a*) **the testis or** (*b*) **the epididymis.**
**Hernia.**
**Hematocele.**
**Varicocele.**
**Hydrocele** (*a*) **of the tunica vaginalis;** (*b*) **of the spermatic cord.**

**History.**—Age of patient and general condition; family history of tuberculosis; any previous manifestations of tuberculosis in lungs, bones, joints, or genitourinary tract.

Length of time growth has existed, and if it grew slowly or came on suddenly, and if reducible.

Inquire as to pain, traumatism, gonorrhea, and syphilis. If treatment has been previously used, note the effects of tapping and inunctions of mercury and iodide of potassium in large doses.

**Examination.**—*Palpation.*—Observe if the body of the testicle is involved, or the epididymis, also the size, shape, and density of the tumor particularly with reference to fluctuation, elasticity or stony hardness. Note if the spermatic cord is enlarged or not, and if the tumor is reducible; if the inguinal ring is open and enlarged, and if an impulse is felt on coughing.

The condition of the scrotal veins should be examined with the patient standing upright, for a varicocele always disappears when the individual lies down.

The sign of **translucency** is obtained by examining the tumor with transmitted light.

In the presence of a solid tumor or hernia, the light is obscured; but in a simple hydrocele, with clear contents and thin walls, the light passes through. If the walls of the sac are thickened, or if it is filled with blood or chylous contents from lymph, and in the tropics, filaria, the light is not transmitted, and the hydrocele appears opaque.

**Puncture of the tumor with an aspirating needle** never does harm, and often may clear up the diagnosis by demonstrating the presence and character of the fluid withdrawn, or the fact of its absence.

When, in spite of the methodic examination, doubt exists in the surgeon's mind as to the nature of the growth, the patient should be prepared for operation, etherized, and a free incision made over the tumor, which can then be dealt with as occasion requires.

# CHAPTER XL

# IMPOTENCE AND STERILITY

## IMPOTENCE

Impotence may be defined as an inability on the part of the male to copulate, either on account of a failure of the penis to become erect, or because the ejaculation of seminal fluid takes place prematurely and before the penis has entered the vagina or else does not occur at all.

The mechanism of copulation is a complicated one, and requires for its performance the coordinated working of both nervous and muscular systems. The function of erection is known to be under the control of a collection of nervous ganglia, situated in the lumbar enlargement of the spinal cord, which is called the **center of erection.** The center of erection receives nerve filaments from the genital center in the brain, and it also receives sensory fibers from the rectum, bladder, and genitals. It also sends out nerves, the *nervi erigentes,* to the genitals, whose function is to cause a vasomotor paresis of the blood vessels in the corpora cavernosa.

A knowledge of the distribution of these various nerves serves to explain the following facts: An erection may be provoked by the influence of the brain, if it entertains libidinous ideas, or an *inhibitory influence* may be exerted from the brain by the mental emotions of fear, disgust, or fright (psychical impotence), and vigorous mental activity has the effect of removing, for the time being, sexual desire.

Certain forms of irritation of the spinal cord, caused by myelitis, traumatism, or fracture dislocation, when the lesion is located in the cervical or upper dorsal region, are often attended with persistent and powerful erections of the penis.

Erections are also caused by peripheral irritation from the genitals, transmitted along the nerves leading to the center of erection in the cord. At this point, as a result of irritation of the genitals, the sensory impulse is converted into a motor one and reflected back again to the genitals along the *nervi erigentes.*

As common illustrations of erections from peripheral irritation may be mentioned the erections occasioned by a bladder filled with urine in the morning, prostatic enlargement, or the passage of a sound through the deep urethra.

## Mechanism of Erection

The mechanism of erection is as follows: Under the influence of the nervi erigentes a relaxation of the vascular spaces in the corpora cavernosa takes place, and they fill with blood. The penis becomes erect, hard, and elongated, because the blood is pumped into the spaces and retained there.

If the blood flowed out of the erectile tissue as fast as it came in, erection could not occur; but the swelling of the corpora cavernosa exerts a certain degree of pressure upon the veins which ordinarily conduct the outflowing blood away from the penis. The return-flow of blood is checked by the pressure on the veins, and it is retained in the spaces of the erectile tissue of the penis.

Unless the spaces of the erectile tissue be completely relaxed, a sufficient quantity of blood can not enter them to exert pressure on the outgoing veins, and the blood flows away through them.

## Mechanism of Ejaculation

In a normal condition ejaculation only occurs with a fully erect penis, except during sleep.

As the spaces of the corpora cavernosa become filled with blood, the verumontanum, or colliculus seminalis, which is composed of erectile tissue, also swells and becomes erect, thus blocking the entrance to the bladder, so that urine can not flow out.

The urethral glands secrete freely and a viscid clear drop of mucous appears at the orifice of the urethra. The object of the secretion is to cover the urethral walls bathed in acid urine and to prepare them for the reception of the semen.

The contents of the seminal vesicles are poured out through the ejaculatory ducts, until the posterior and bulbous dilatations of the urethra become filled with semen, and after these are distended contractions of the bulbocavernosus muscles occur, and the semen is ejaculated in jets from the meatus. If the force of the muscles is impaired, as in paralytic impotence, the semen is not shot out in jets, but dribbles slowly away from the meatus.

## Classification of Forms of Impotence

I. Organic, from mechanical defects.

II. Psychical, or imaginary: 1. Complete. 2. Relative.

III. Atonic, from exhaustion of genital centers in brain and spinal cord.

IV. Symptomatic: Variety A. Irritable Impotence, from disease in urethra or adnexa. Variety B. Paralytic Impotence, from organic disease in nervous system. Variety C. Impotence due to Drugs.

## ORGANIC IMPOTENCE

In this form of impotence some physical cause, which is either congenital or acquired, renders coitus mechanically impossible. The obstacle may prevent the introduction of the penis into the vagina, or, in the absence of a urethra, while coitus can be performed, it is not possible to inject the semen into the vagina.

Among the causes of organic impotence may be mentioned such failures of development as hypospadias, epispadias, small size of the organ; or acquired deformities (such as elephantiasis and tumors), disease of the corpora cavernosa (such as syphilitic or fibroid induration), or partial destruction following wounds, and cavernitis are sometimes responsible for interference with coitus, and operate by causing a deviation or curve in the penis upon erection.

Swelling of the surrounding parts, such as hernia, scrotal tumors, or excessive corpulence, with an overhanging belly, may render insertion of the penis impossible, but the sexual desire is strong, and ejaculation occurs.

### Treatment

In organic impotence the treatment will be successful in so far as it is possible to remove the mechanical obstacle to copulation.

In hypospadias and epispadias a plastic operation can be performed, and, when the penis is completely inclosed by overlying tissues, a small, freely movable penis capable of intromission may be formed.

Tumors and elephantiasic growths must be removed by surgical means, and hernia and hydrocele also call for operation. An effort should be made to bring about absorption of the infiltration in the corpus spongiosum, which may be confidently expected to occur if it is syphilitic in origin.

## PSYCHICAL IMPOTENCE

We have already noted in studying the physiology of coitus the fact that the brain is capable of exerting a restraining influence over the power of erection, through the inhibitory nerves which go to the spinal center of erection. As a result of nervous excitement, the action of the inhibitory nerves from the brain is aggravated, and erection fails at the critical moment. The influence of fear and dread are observed in the same class of patients before passing a sound.

When these individuals are lying on the table, the penis is seen to shrink and grow smaller and move in a worm-like manner, which is caused by the spasmodic contraction of the muscular fibers imbedded in the trabeculæ of the corpora cavernosa. In such cases the inhibitory nerves are stimulated by the dread of catheterism; in the same way other psychical influences stimulate the action of the inhibitory nerves, and the patient is at such moments impotent.

Various types of men are affected by the form of psychical or imaginary impotence, as follows:

**Class A.**—A few strong, young, vigorous men who have led clean lives, on being married to the women of their choice, either from a state of nervous excitement or a lack of confidence in themselves, or perhaps occasionally from timidity and bashfulness, do not succeed in holding an erection long enough to perform coitus, and the erection either fails to be complete or else ejaculation occurs prematurely.

**Class B.**—Feeble, despondent, oversensitive individuals of weak nervous fibers who have masturbated, had an attack of gonorrhea, or have been excessive in sexual intercourse. Such persons are continually dwelling on past abuse and worrying over trifling symptoms, such as a varicocele or the normal weekly occurrence of a seminal emission, and their fears are aggravated by reading quack books.

**Class C.**—Men of good health and well-balanced minds may be affected by various mental emotions, such as fear, disgust, and loathing, or the departure from regular habit, all of which may induce temporary impotence.

It is no uncommon experience, when illicit intercourse is being attempted, that a fear of exposure or infection, or of disgust at some coarse remark on the part of the woman, causes a failure or sudden subsidence of the erection.

The effect of habit is seen in the cases where a man is accustomed to cohabit successfully with one woman, but fails to accomplish the act of coitus with a stranger, until he becomes accustomed to the new fields. Roubaud's case is cited as an example of this. A young man who was accustomed from the beginning of his sexual life to a certain type of woman, who was a blonde and always met him dressed in a silk gown and with shoes on, could never have coitus with any other woman, unless she were also a blonde and dressed in a similar manner.

Severe and prolonged mental strain, such as occurs with students, business and professional men, sometimes brings about a condition of general neurasthenia, one of the symptoms of which is temporary impotence.

**Relative impotence** is a form of psychical impotence, and is the term applied to a condition in which the man is able to copulate with certain women only, and not with others.

When this is the case between man and wife, it may be due to a mutual aversion or a lack of sexual feeling on the part of the wife, which reacts upon the man and takes away his desire, and yet the same man may be entirely potent with other women.

### Treatment

Before beginning treatment, it is essential to make sure that we are dealing with a case of true psychical impotence and that the impotence is not *symptomatic* of some lesion in the urethra or nervous system.

The psychical form disappears spontaneously when the mental disturbances occasioning it vanish. For instance, the death of a beloved wife or loss of fortune and business anxieties may cause temporary impotence, which disappears as time goes by or the individual's circumstances improve. In these cases the friendly advice of a physician in whom the patient has confidence is valuable.

Hypnotism may be successful in relieving this form of impotence, but, as our knowledge of influencing the mental powers in this way becomes more extended, the danger of inducing the hypnotic state and other drawbacks becomes more obvious; so that, in general, it is not desirable to employ this form of treatment.

The largest number of cases of psychical impotence occur in nervous young men who have had gonorrhea or masturbated freely, and who have read and pondered over the false and lurid accounts in quack medical advertisements, pretending to describe the evil consequences of masturbation or sexual excesses.

## ATONIC IMPOTENCE

Until within a very few years a knowledge of the effects of chronic posterior urethritis and disease of the colliculus in inducing impotence was not understood, and it was not until the invention and application of the posterior urethroscope, in studying those conditions, that a clear understanding of them was obtained.

As a result of the lack of definite knowledge the term atonic impotence was often used in a very incorrect way to describe cases where the impotence was due to local changes in the posterior urethra, or spinal cord, which should be properly classed under the term symptomatic impotence.

Atonic impotence is a variety of comparatively rare occurrence, and in which there is no demonstrable lesion of the nervous system or urethra. It is purely functional in character, and is dependent entirely upon a failure of the spinal center of erection, and perhaps the genital center in the brain, to respond to ordinary stimuli and cause the penis to become erect.

It should be borne in mind, however, that a condition of exhaustion of the nerve-centers is often complicated by chronic inflammatory changes in the posterior urethra, induced by a gonorrhea of long standing or sexual abuse, and this fact should not be lost sight of in carrying out the treatment.

In atonic impotence sexual desire is often present, but frequently it is absent, and, as a rule, erections do not occur at all. Sometimes, however, in mild cases, a partial erection, accompanied by premature ejaculation of semen, takes place.

The lack of erectile power is usually only one symptom of general neurasthenia, which is accompanied by its usual signs, viz., mental symptoms, such as impairment of memory, fullness in the head, and anxiety; pains in the back and limbs, feeble heart action, vasomotor disturbances, indigestion, constipation, etc.

These general symptoms have been described by quacks in terrifying terms, in pamphlets pretending to set forth the "evil effects of self-abuse," which have an extensive circulation among the laity.

## Diagnosis and Treatment

Before making a diagnosis of atonic impotence care should be taken to exclude any disease of the urethra and its adnexa or the nervous system. It is generally the case that, with old rounders and masturbators, a stricture, chronic urethritis, prostatitis, seminal vesiculitis, or beginning spinal disease is present, and the impotence is not atonic and caused by exhaustion of the nervous centers, but is secondary to and a symptom of the local structural change in urethra or spinal cord.

When all these local conditions have been excluded, however, and we are certain that we are dealing with a pure functional neurosis, the following lines of treatment may be employed:

The indications are to build up the general health of the patient, and at the same time give complete rest to the genital centers in the brain and cord; so that their cells may have an opportunity to store up again a renewed quantity of nervous energy.

Later on, after a sufficiently long period of rest has been enjoyed, a plan of treatment should be adopted calculated to stimulate and arouse again to activity the dormant cells in the genital centers; but this should never be attempted until a sufficient period of complete repose has been afforded them.

The neurasthenia, which is usually present, requires the first attention, and the patient should be directed to make use of a light, easily assimilated diet, get plenty of sleep, and take gentle, regular exercise in the open air.

Riding on horseback and the bicycle are not to be recommended, on account of the jarring to which the perineum is subjected when these are indulged in. Sea-bathing has an excellent effect as a general tonic.

Especial stress should be laid upon the necessity for avoiding all sources of erotic excitement, such as lewd books, conversations, and theatrical displays; companionship of women, immoral or otherwise, and all attempts at sexual intercourse must be rigorously interdicted.

In the early stages of treatment, in addition to blood- and tissue-building tonics,—such as codliver oil and iron,—the spinal sedatives—bromide of potash and lupulin—are in order for the purpose of giving the necessary rest to the exhausted centers.

After this treatment has been continued for some weeks and the patient's neurasthenia has disappeared, it sometimes happens that his sexual functions are improved as well; but frequently the irritability of the genital center is still so exhausted that erections either do not occur at all or are not sufficiently vigorous, and ejaculation is premature; so that a special stimulating plan of treatment has to be adopted to arouse the activity of the cells in the genital centers.

The drugs which are supposed to be particularly useful as stimulants to the nervous centers are phosphorus and nux vomica. They may be combined in the following manner, as suggested by Gross:

R Quininæ sulphatis,
Ferri sulphatis ....................āā gr. xl
Zinci phosphidi ...................... gr. ij
Acidi arsenosi ...................... gr. iss
Strychninæ sulphatis ................ gr. ⅔
M. et ft. pil. no. xl.
Sig.: Two pills every eight hours.

Damiana and cantharides have gained some reputation among the laity as aphrodisiacs, but damiana has little or no effect, and cantharides acts as an irritant upon the kidneys and bladder whenever taken in doses sufficiently large to act as a genital excitant.

An extract from the anterior lobe of the pituitary body or pituitrin has recently been recommended as a stimulant to the erectile power in cases of atonic impotence.

Yohimbin, which is an alkaloid, in moderate doses (gr. 1/10 t. i. d.) is said to cause prompt appearance of erections, in cases of impotence, by producing dilatation of the blood vessels in the genital organs. In excessive doses it may cause hallucinations, hyperemia of the skin and mucous membranes, as well as the genitals. Its action as an aphrodisiac is inconstant and often disappointing.

It was hoped that when the animal extracts were first introduced they might prove of value, but extended trials of them have only resulted in disappointment.

Electricity enjoys a high reputation in the treatment of atonic impotence. The constant current is adapted to most cases, beginning with the positive pole applied over the lumbar region and the negative pole used to stroke the penis, testicles, and perineum. The strength of the current may be gauged by the sensitiveness of the patient, and it should not be used strong enough to cause discomfort. The sittings at first should be for two or three minutes every forty-eight hours, and soon increased to five minutes daily. In obstinate cases, if erections do not occur from these applications, the positive electrode may be introduced into the rectum and a more powerful effect excited. In cases where marked anesthesia of the skin of the genitals exists the faradic current may be used with better results than the galvanic.

Cold douches, or the alternate use of cold- and hot-water douches, applied with some force to the spine daily, are of some assistance, and in the same way irrigation of the rectum with hot water through a Kemp tube may be of some service as a local stimulant to the prostatic urethra.

Local treatment of the urethra is, of course, demanded when atonic impotence is complicated by chronic inflammation of the posterior urethra (see Symptomatic Impotence); but in cases where the posterior urethra is healthy and the difficulty is a pure neurosis, the passage of sounds and use of instillations generally increases the neurasthenia, and the patient is made worse.

The operation of ligation of the dorsal vein of the penis has been practiced with the object of retarding the return flow of blood, and so allowing the erectile tissue of the corpora cavernosa to become distended and filled up with blood, in the cases where a partial erection occurred, but where the penis almost immediately became flaccid without any discharge of semen. A few cases have been reported where this operation proved successful, but the mental effect of an operation may have been partly responsible for the good result.

After the condition of impotence has yielded to protracted and careful treatment, and the patient is again able to have erections and ejaculate normally, he should be warned against indulging too freely in sexual intercourse, for any excess in this line will be very apt to be followed by a recurrence of his former disability.

## SYMPTOMATIC IMPOTENCE

This is by far the most frequent type of impotence met with in practice. The disability is never primary, as in the other forms, but it is always dependent upon and secondary to certain structural pathologic changes located in the nervous system or the urethra and its adnexa, and the inability to copulate is only one symptom of many which go to make up the clinical picture.

In symptomatic impotence erections may be completely absent, although, as the genital centers in the nervous system are not affected, sexual desire is usually present.

In many cases a partial erection of the penis takes place, and the seminal fluid is ejaculated prematurely. This form is generally spoken of as irritable impotence.

### Variety A. Irritable Impotence

This term is derived from the fact, that on account of the irritable state of the posterior urethra, the ejaculation of semen occurs prematurely before the penis has penetrated into the vagina, and the organ, which never attained to a complete erection, becomes flaccid immediately after the discharge. Many of these cases, which are characterized at first by premature ejaculation, grow worse, and in time the power of erection disappears entirely.

Irritable impotence generally depends upon the presence of chronic posterior urethritis, and the inflammation often extends from the urethra through the ejaculatory ducts, and the prostate and seminal vesicles become affected also.

The most frequent causes of chronic posterior urethritis are: the habit of interrupted coitus or "withdrawal," masturbation, excessive sexual intercourse, various forms of sexual perversion, or an uncured posterior gonorrhea.

One of the most detrimental habits to the general health which a respectable married man can fall into, for the purpose of preventing conception, is the form of marital masturbation known as "withdrawal," or onanism. The rapidity with which the evil effects follow depends upon the individual. In a high-strung nervous man, the bad effects are observed sooner than in one of a more phlegmatic and vigorous type; but in every case, sooner or later, the evil results follow. Masturbation and sexual excesses all act in the same way, and induce a chronic engorgement of the blood vessels in the posterior urethra, with a swelling and enlargement of the colliculus. In course of time hyperplasia of the submucous connective tissue occurs, and the newly formed scar tissue, pressing upon the delicate nervous structures of the verumontanum, occasion various reflex symptoms in the brain, nervous and muscular systems. The process is often further complicated by germ infection, often the *Bacillus coli,* which aggravates the existing conditions.

Instead of a chronic posterior urethritis being responsible for the reflex disturbances, an organized stricture may be present in the pendulous urethra, and if the stricture is located in the deeper portion of the canal, it interferes so much with the circulation of blood in the posterior urethra that a chronic congestion results, which disappears promptly when the stricture is treated.

## Treatment

To treat the symptom of irritable impotence successfully, the condition in the posterior urethra requires attention. (See Chronic Urethritis, Prostatitis, and Seminal Vesiculitis.)

If pus is present and the urine is turbid, irrigations of the urethra are indicated; and if the prostate is diseased, it must be treated by massage.

As a rule, however, most of the cases present only a condition of posterior urethritis and swelling of the colliculus, which can be readily demonstrated with the posterior urethroscope by one who is skilled in its use.

Oftentimes, perhaps in one-fourth of the cases, small polypoid vegetations are seen growing from the upper surface of the colliculus.

Applications of strong solution of nitrate of silver (gr. 50 to 100 to the ounce), removal of polypi by twisting them off with the forceps, and in the most intractable cases touching the surface of the colliculus with the red-hot galvanocaustic point rapidly relieve the condition of local hyperemia and swelling; when this is restored to the normal, the symptoms dependent upon it disappear.

The writer knows of no class of cases in genitourinary work which are as completely and promptly helped by proper treatment as those just described, but to use the posterior urethroscope successfully requires a certain technic which must be learned by practice.

### Variety B. Paralytic Impotence

In paralytic impotence erections do not take place at any time, although half-erections sometimes occur. Ejaculation does not occur at all, or else takes place without causing any sensation, and the semen is not ejected in jets, but gradually oozes from the meatus.

On examination the genitals are found withered and flaccid, and the skin of the penis is but slightly sensitive, often quite anesthetic. The sensitiveness of the urethra is diminished, and a sound may be passed with ease and without pain.

Paralytic impotence, as its name implies, is dependent upon organic cerebral or spinal disease, which causes paralysis in other parts of the body. Blows upon the back of the head are especially liable to be followed by complete impotence.

In locomotor ataxia in the early stages, there may be a condition of priapism, but as the case progresses the sexual powers decline, until finally the patient may be completely impotent. Myelitis in mild forms does not affect the sexual powers, but in severe forms a state of impotence is induced.

The prognosis in paralytic impotence is, of course, bad, and treatment, either local or general, is of little or no use.

### Variety C. Impotence Resulting from Drugs

Sexual power is sometimes diminished or entirely destroyed from the excessive use of certain drugs. Individuals who are addicted to the habitual and excessive use of opium, chloral, bromide of potash, and hashish are very apt, in time, to lose sexual inclination and power to copulate. Workmen who are exposed to the exhalations of certain chemicals—such as arsenic, antimony, and lead—are affected in the same way.

The influence of an excessive amount of alcohol in reducing sexual power is a matter of common knowledge, but we are not so certain as to the effects of tobacco, although some authorities claim that tobacco has an effect of lessening both sexual inclination and capacity.

An excess of sugar in the blood, which occurs in diabetes, also causes impotence, although the individual's health and strength are apparently not deteriorated.

**The treatment** of impotence resulting from the use of drugs consists, of course, in removing the cause, and when this can be done the prognosis is, in general, favorable.

## STERILITY

Until recent years a condition of sterility was always thought to be due to some pathologic condition on the part of the woman, which prevented conception. It is now recognized that in a small number of cases, although the man is capable of performing the sexual act, still his semen is destitute of the fecundating element, and he is sterile.

As an example of this state may be cited the case of men who have been castrated. After this operation the subjects do not become impotent at once, but for a year or two after the testicles have been removed are able to practice copulation and ejaculate a material composed of urethral mucous and secretions from Cowper's and the prostatic glands, but devoid of spermatozoa, and hence incapable of impregnating the female.

**The composition of normal semen,** after ejaculation, is found to consist of spermatozoa formed in the testicles and the secretions of the seminal vesicles, prostate, Cowper's glands, and the glands of the urethral mucous membrane, viz., Morgagni's crypts and Littré's glands.

The usual quantity of semen ejaculated at one discharge is from ʒij-iv, but, if coitus is repeated frequently, the quantity becomes smaller each time, until finally only a few drops are produced with difficulty.

The essential life-giving element in semen is, of course, the spermatozoa, and the function of the other ingredients is probably to coat the urethral mucous membrane and dilute the semen.

On microscopic examination the spermatozoa present a most striking picture, showing numerous small, tadpole-shaped bodies moving actively in the field. They continue to show movements until at least twelve hours after evacuation, and will present signs of activity for forty-eight hours if sheltered from light and cold.

The semen also contains *spermatic cells*, which are supposed to be breeding-places for the spermatozoa, one of which, according to Kölliker, develops out of each nucleus of a cell. ***Böttcher's* crystals** are discovered on adding a few drops of 1 per cent **solution of phos-**

phate of ammonia, and appear as variegated groups of dagger-shaped crystals. It is supposed that the organic base of the crystals exists in the secretion of the prostatic follicles, and gives the semen its characteristic odor.

Finger classifies the pathologic changes in the semen which cause sterility as follows:

I. Azoospermia, or absence of spermatozoa.

II. Oligozoospermia, or a marked diminution in the number of spermatozoa.

III. Necrospermia. The spermatozoa are dead and without motion.

IV. Aspermia, entire absence of semen: 1. Absolute. 2. Temporary.

## I. AZOOSPERMIA

In this condition there is an entire absence of spermatozoa. The physical character of the semen is not distinguishable from normal; the odor, consistence, and color are unchanged, and the absence of spermatozoa can only be detected by the microscope.

Azoospermia is, of course, the normal condition before puberty, but it is rarely found in old men, who usually are able to form a few spermatozoa.

The pathologic causes which bring about this condition may be grouped as follows:

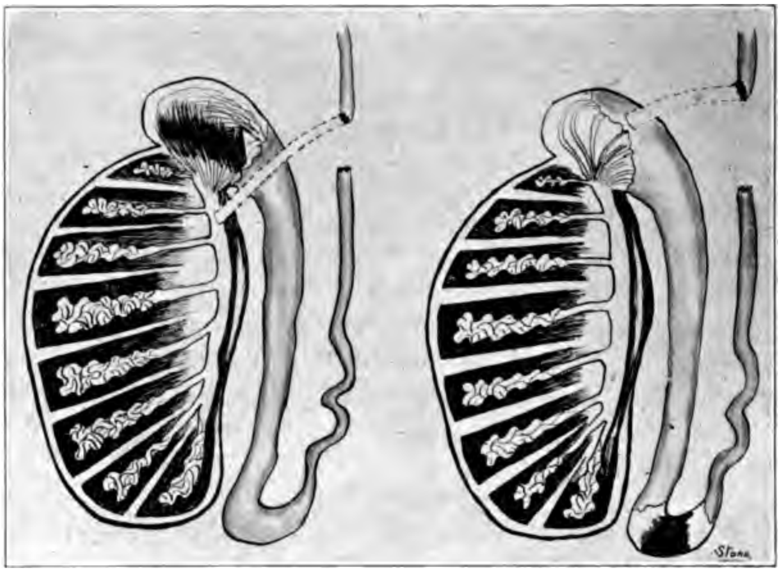
(*a*) *Frequent seminal emissions,* either from excessive masturbation or too frequent coitus cause first a diminution in number, and, if persisted in, a complete disappearance of spermatozoa, which reappear in the semen again after a few days' rest.

(*b*) *Disturbance of the Secreting Function of the Testicle.*—This generally occurs in the acute fevers and the debility following convalescence, and, as a result, the spermatozoa disappear temporarily from the semen. In chronic diseases the same often occurs, and azoospermia often exists in tuberculosis and in syphilis, even when the testicles are not affected.

(*c*) **Disease of the testicle,** caused by syphilis, tuberculosis, or malignant disease, if it is bilateral and destroys completely the parenchyma of the organ, interferes with the formation of spermatozoa and leads to sterility. It is necessary, however, that it should be a complete destruction, for if a small part of the secreting portion is left, spermatozoa may still be formed.

(*d*) **Absence of both testicles**—either from removal by castration, atrophy consecutive to orchitis, congenital absence, or atrophy following ectopia testis—will, of course, induce permanent and irremediable sterility.

(*e*) **Bilateral obstruction of the vas deferens** is the commonest cause of azoospermia, and results from epididymitis, which in 90 per cent of the cases is due to gonorrhea. Tuberculosis and syphilis are responsible for the remaining 10 per cent. The obliteration of the vas deferens is caused by the pressure, upon the seminiferous tubes, of a mass of inflammatory scar tissue in the tail of the epididymis, which contracts and squeezes the tubes together. Finger cites 242 cases of double epididymitis, out of which 207 suffered from azoöspermia.



A. B.

Fig. 293.—Operation of Vasostomy. *A*. Infiltrate in head of epididymis. Vas deferens transplanted into body of testicle. *B*. Infiltrate in tail of epididymis. Vas deferens transplanted into head of epididymis.

(*f*) **Exposure to X-rays.**—F. Tilden Brown reports that men by their mere presence in an x-ray atmosphere, incidental to radiography or the therapeutic uses of the rays, after a period of time—as yet undetermined—will be rendered sterile. Ten individuals who have devoted more or less time to the work during the past three years—not one of whom has had any venereal disease or traumatism involving the genital tract—have been found to be the subjects of absolute azoospermia. None of the number are conscious, however, of any change or deterioration in regard to their potency.

**The treatment** of azoospermia seldom meets with much success, except in cases of syphilitic epididymitis. Here an energetic course of antisyphilitic medication will often cause absorption of the infiltration, and the testicle resumes its function.

In gonorrheal epididymitis the infiltration is hard and dense, and after it has existed some little time it is impossible to bring about its absorption. It is important, for this reason, to treat every case of gonorrheal epididymitis carefully, in order to avoid the danger of sterility. (See Epididymitis.)

On account of the impossibility of restoring the patulousness of the vasa deferentia by ordinary treatment, after they have been occluded by double epididymitis, Edward Martin[1] devised and successfully practiced the operation of **anastomosis between the vas deferens and the epididymis.**

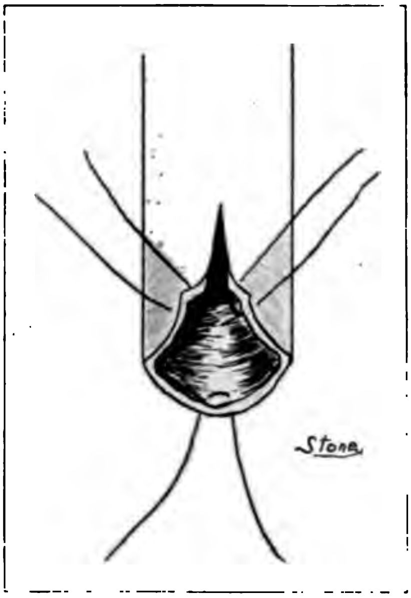


Fig. 294. Vas deferens divided. Longitudinal incision made and sutures introduced ready for anchoring.

The operation consists in cutting off the vas above the obstructed point, splitting its end, and sewing the split end into an incision made in the epididymis. In other cases a lateral anastomosis is made. The technic of doing a lateral anastomosis is described by Francis R. Hagner[2] as follows:

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[1] Tr. Am. Urol. Soc., 1909.
[2] Med. Rec., Aug. 10, 1907.

The instruments used are the knives, scissors, forceps, and needles customarily used by the eye men. The patient is etherized and an incision is made through the skin and coverings of the epididymis which is approached from the outer side so as not to wound the spermatic artery. The artery of the vas is pushed aside and a half-inch incision is made in the vas deferens on the level with the globus major along its axis, care being taken to get into the lumen of the tube. A portion of the globus major is picked up between two fine forceps and an elliptical piece removed to correspond with the incision in the vas deferens. An examination of the fluid obtained by squeezing the globus major will show spermatozoa. Four fine silver-wire sutures on curved intestinal needles are inserted, one at the upper angle of the wound joining the vas and the cut surface of the epididymis, one at the lower angle, one at the outer, and one at the inner side. When these are drawn out a perfect little pocket is formed by the spreading out of the cut vas deferens, and the elliptically cut globus major. The wound is then closed and dressed. It will be seen that the operation is not one of grave danger to life. It is one in which the existing

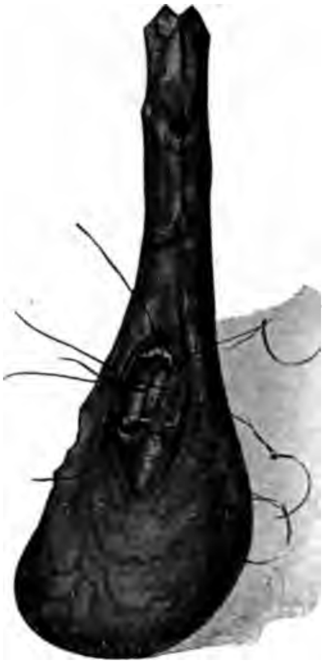

Fig. 295. -Anastomosis between the vas deferens and the head of the epididymis.

condition can not be made worse, but where, in fact, everything is to be gained and nothing to be lost.

The spermatozoa may not be found immediately; sometimes as long as a month or more may elapse before they appear in the successful cases probably on account of a temporary occlusion by hyperemia of the restored canal. Martin reports that the anastomosis operation in his hands has been followed by a reappearance of healthy spermatozoa in 6 cases, and 3 previously sterile marriages have been rendered fertile.

He also states that in the majority of cases presenting themselves because of azoospermia the obstruction was not in the epididymis. In 2 cases there was a congenital absence of the vasa deferentia.

## II. OLIGOZOOSPERMIA

This condition consists in a marked diminution of the number of the spermatozoa, and may, in general, be regarded as a temporary condition, which, depending upon its cause, either returns to the normal state or goes over into complete absence of spermatozoa (azoospermia).

Oligozoospermia occurs normally in old age and at the beginning of puberty, and it also occurs in general debility from any disease and also after repeated acts of sexual intercourse. The most usual causes for it are gonorrheal epididymitis or new growths—either syphilis, tuberculosis, or cancer—which involve the epididymis.

So long as the vasa deferentia are not completely closed by the inflammation, a few spermatozoa may make their way through the canal. If the spermatozoa are diminished in number, and at the same time motionless, sterility is assured; but if the spermatozoa retain their movement, there is always procreative power left, but in a lessened degree.

## III. NECROSPERMIA

In this condition the male is able to copulate and to ejaculate semen but on microscopic examination the spermatozoa are found to be dead and without motion. In order to make a valid test, it is necessary to examine the semen not later than one to two hours after ejaculation, and the specimens can only be secured by directing the man to have coitus while wearing a condom.

Necrospermia is brought about by a variety of causes which diminish the secreting capacity of the testicle. Excesses in venery or unduly frequent seminal emissions operate in this way. At first the semen is normal, but in time it becomes thinner, the number and motility of the spermatozoa diminish; they become small, deformed, and unripe.

The same effect is produced upon the spermatozoa by a disturbance in the nutrition of the testicle from alcoholism, morphinism, general tuberculosis, or diabetes. Various local processes—such as syphilis, carcinoma, and beginning atrophy—exert their effect upon the parenchyma of the gland, and the formation of spermatozoa is affected in consequence.

A more frequent cause of the death of the spermatozoa is some pathologic alteration of the component parts of the semen. Inflammation of the seminal vesicles, either acute or chronic, causes perceptible alteration in the semen. It is usually purulent and sometimes bloody, deriving its foreign constituents from the inflamed cavities of the vesicles, and the spermatozoa are found to be dead.

The spermatozoa are also motionless in cases of chronic follicular prostatitis, for, as Fürbringer has demonstrated, the spermatozoa, so long as they are retained in the seminal vesicles, are motionless, and it requires the contact of the prostatic secretion to arouse their normal motility. When the prostatic follicles are diseased, their secretion is checked, and the spermatozoa are deprived of the stimulant necessary to excite their activity.

As already indicated, the treatment of necrospermia will depend upon the cause that occasions it, and the prognosis is good or otherwise as we are able to remove its origin.

## IV. ASPERMIA

Aspermia may be defined as a condition in which the male is able to perform coitus properly, but no semen is ejaculated into the vagina of the female, either because none is secreted or because some obstruction in the urethra prevents its passing from the meatus.

Aspermia may be either absolute or temporary, congenital or acquired.

**Congenital aspermia** is a very rare condition, but a few cases have been reported. Ultzmann assumed it to be due to a nonexcitability of the reflex center of ejaculation. Jacobson suggests that, while the testicles are present and capable of forming spermatozoa, they can not make their way into the urethra on account of an occlusion of the ejaculatory ducts or an absence, from anomaly of development, of a portion of the vas deferens.

**Acquired aspermia** is not uncommon, and is often the result of suppurative affections of the prostate brought about by gonorrhea or tuberculosis. Through the destruction of the gland and the subsequent formation of scar tissue, the ejaculatory ducts are closed by the contraction of the cicatrix. If one duct is left open, the semen is diminished in quantity, but not noticeably so; if both ducts are closed, aspermia follows.

The ejaculatory ducts are also occasionally destroyed during a lateral lithotomy, either by being cut, in incising the posterior urethra, or by suffering laceration in dragging a large stone out of the bladder and through the wound.

The ejaculatory ducts sometimes become plugged by the formation of concretions, composed of spermatozoa, mucus, epithelial cells, and lime salts.

An insensitive condition of the glans penis may be responsible for the failure of ejaculation, and cases have been reported where an injury to the spine caused a complete anesthesia of the skin of the genitals. In another case on record the prepuce and dorsum of the penis had been destroyed by ulceration and converted into a large indurated scar, which was entirely insensitive.

One of the most frequent causes of aspermia is stricture of the urethra. On account of the swollen and turgid condition of the mucous membrane of the urethra during coitus, the orifice of a tight stricture is closed, and the seminal fluid is unable to escape past it, but is retained in the urethra behind the stricture. After the congestion subsides the verumontanum no longer closes the vesical outlet, and the semen regurgitates into the bladder, and is subsequently discharged with the urine.

**Temporary aspermia** is a rare condition which occurs in persons of a nervous temperament who become neurasthenic from excesses in venery, masturbation, or gonorrhea. Such individuals are usually impotent (psychical impotence), but occasionally such patients are found who can copulate, but can not ejaculate any semen at the time, although the seminal fluid may escape a few hours later during sleep, as an emission. This form of aspermia begins suddenly, lasts a few weeks or months, and then vanishes as suddenly as it came.

The treatment of aspermia in its various forms depends upon the etiology, but the variety depending upon stricture offers a good prognosis when the urethra is restored to its normal caliber.

# CHAPTER XLI

# CHANCROID AND ITS COMPLICATIONS

## CHANCROID

**Synonyms.**—Soft chancre, or simple venereal ulcer.

The etiology of chancroid was, until very recently, involved in obscurity. There were two views held as to its exciting cause.

One opinion (*a*) as to the causation of chancroid, which was generally accepted, was that chancroid is merely an active form of wound-infection and that it is caused by the inoculation under the skin of any of the pus-producing microorganisms, and in this and other respects resembles, clinically, impetigo contagiosa or ecthyma.

The other view (*b*) is that chancroid is due to a particular microorganism produced in another chancroid, and called, after its discoverer, the **Bacillus of Ducrey.** This was not universally accepted at first, but the experiments of Bezançon, Griffon, Le Sourd, and Lenglet, in making cultures and inoculations, have within the past six years decided the question definitely, and today Ducrey's bacillus is accepted as the pathognomonic organism of chancroid.

The experiments above mentioned were confirmed by Tomaszewski,[1] who inoculated two apes with chancroidal virus. These were followed by sores from which he made pure cultures, inoculated himself, and recovered the bacillus of Ducrey.

An abrasion of the skin is necessary for the penetration of Ducrey's bacillus, but it may be so slight, especially on a mucous membrane, that it is not noticed. The pus may also be introduced into the open mouth of a follicle of the skin.

### Frequency of Chancroid

Chancroid is more common among the lower classes than among the cleanly and well-nourished people, as its development is favored by filthy habits and dirty surroundings, and all the accompaniments of privation and misery.

The frequency of chancroid grows less every year, diminished, no doubt, by the increase of cleanliness, and it is most unusual in private practice to see a patient affected with a chancroid.

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[1] Arch. f. Bacteriologie, 1904.

### Modes of Contagion

(*a*) *Immediate: i. e.*, through direct contact, as in coitus, or by digital examination, etc.

(*b*) *Mediate*, in which contact is not made with the chancroid, but some of the pus is deposited upon an instrument, towel, chamber utensil, water-closet seat, etc., and from this point is brought into contact with another person, who becomes infected.

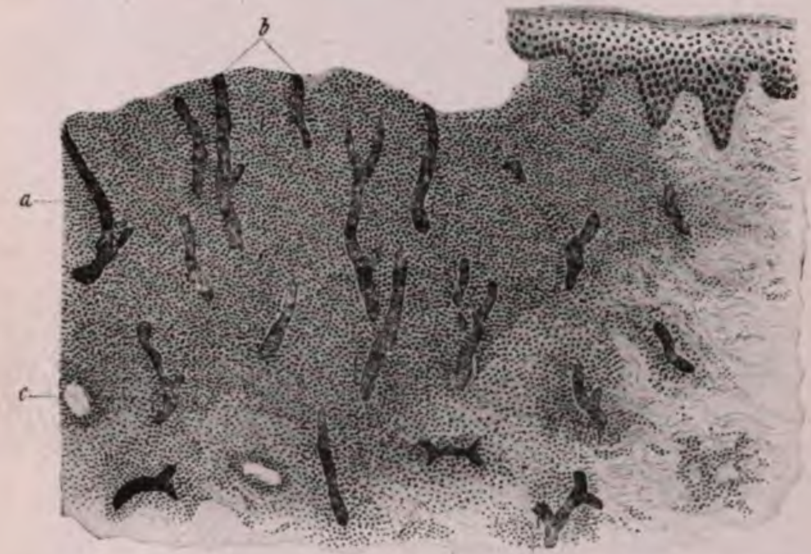

Fig. 296.—Section of chancroid. *a*, small round-celled infiltration; *b*, lymphatics, open and gaping; *c*, blood vessel. (From "Die Syphilis und die Venerischen Krankheiten," by Dr. Ernest Finger.)

### Development and Course

Inoculation generally takes place through coitus, and very rarely through the medium of an instrument or other object.

Twenty-four hours after inoculation a red, hyperemic spot is noted, which on the second day has become transformed into a nodule and on the third day into a pustule with a red surrounding areola. This subsequently breaks down and forms a sore with a crust covering the spot.

Chancroid is usually multiple, although it sometimes exists singly. The fact of the sores being multiple is accounted for in the following ways:

(*a*) A number of points are inoculated with chancroidal pus at the time of contagion.

(*b*) Through *autoinoculation.*

Autoinoculation may be defined as the action of pus formed in one chancroid producing other chancroids in the same individual: i. e., the inoculation of the patient with pus from his own chancroid, and the phenomenon of autoinoculation is a characteristic feature of chancroid.

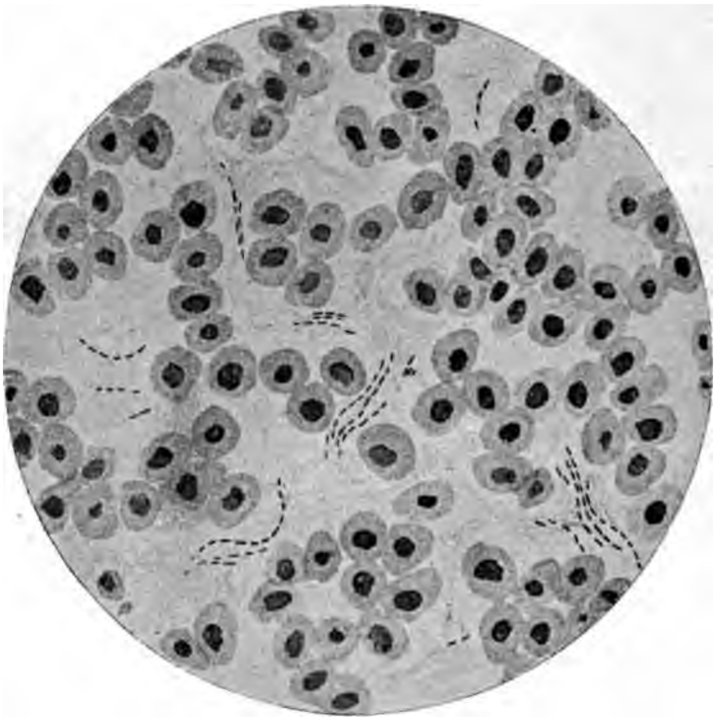

Fig. 297.—Section through the edge of a chancroid, showing Ducrey's bacillus.

The form of the sore depends largely upon its location. If located under the frenum it takes on a figure-of-eight shape and perforates underneath the frenum.

When located upon the penis the chancroid is round, spreading in all directions, and swelling is always present.

If in the sulcus coronarius, a considerable amount of infiltration is always present, because the tissues are naturally denser at that point.

The follicular chancroid, which is formed by infection of a follicle, appears like an acne pustule, and tends not to spread at the periphery, but to go deeply into the tissues.

Its location is generally on the sulcus coronarius and labia majora.

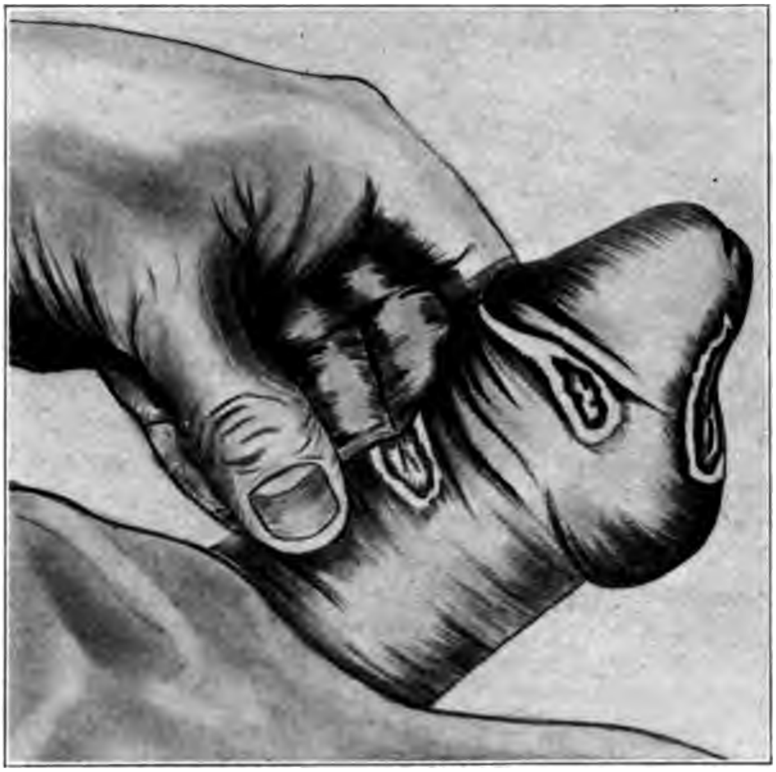

Fig. 298.—Chancroids. (Author's case, Long Island College Hospital.)

## Characteristics

In chancroid there is no period of incubation and it is generally noticed on the third day after coitus.

**The location** is usually on the genitals, although it exceptionally occurs on the fingers.

In **shape** the sore is usually irregular from the confluence of several sores, although it may be round or oval.

**Number.**—It is exceptional for chancroids to exist singly. They are usually *multiple*, either from the simultaneous inoculation of several points at first or from subsequent autoinoculation.

**Pain** is usually present to a considerable extent.

**The base of the sore** in a typical case is ***devoid of induration,*** but if an excessive amount of inflammation has taken place—as a result of insufficient and frequent cauterization, prolonged contact with irritating urine, pus, or acrid secretions—an inflammatory or boggy hardness is often present. This does not feel like the induration of a chancre, which is sharply defined and which resembles a piece of cartilage under the skin, but is doughy or boggy in feeling, and shades off gradually into the surrounding tissues.

Chancroids located in the sulcus coronarius, from the amount of induration which always accompanies them, may easily be mistaken for the initial lesion of syphilis.

**The floor** of the chancroid is rough and uneven, and covered with a dirty-grayish deposit.

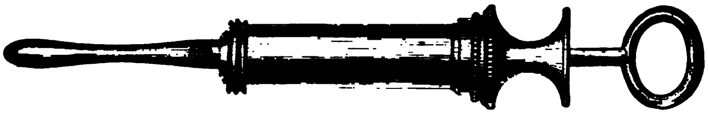

Fig. 299.—Taylor's flat-billed syringe for washing out the balanopreputial sac.

**The edges** of the sore are undermined; the *discharge* is abundant, purulent, and sometimes bloody.

**Duration of the chancroid** may be divided into stages:

*I. Progressive stage,* during which each sore extends by a breaking down and ulceration of the edges, and fresh sores are continually forming as a result of autoinoculation.

*II. Stationary stage.* After a time the pus loses its virulence, autoinoculation of fresh surfaces no longer occurs, and the ulcers cease to increase in size, but remain stationary.

*III. The reparative stage* begins when the sores are covered with healthy granulations and cicatrization is in progress.

The various stages require about six weeks in time for uncomplicated cases, but **relapses from autoinoculation** are very frequent, and delay the healing process.

**Microscopic examination** of a chancroid shows it to be composed of a small round-celled infiltration which takes place in the skin and subcutaneous tissues, and which leads in time to coagulation necrosis.

The lymphatics are not involved, but remain open and gaping, ready to convey microorganisms or toxins to the nearest lymphatic gland, and in this way we can account for the frequent occurrence of bubo.

Until 1852 chancroid was regarded as a syphilitic manifestation; yet the true difference between the two diseases would have been sooner discovered but for the **mixed sore**. It sometimes happens that an individual is syphilitic and has accidentally acquired chancroids.

As a result of contact with both poisons, usually during coitus, another person receives a *double infection:* i. e., the virus of syphilis and that of chancroid are both inoculated at the same moment. The chancroid appears in twenty-four hours, but on account of the longer incubation of syphilis, the chancre is not evident for at least three weeks. After this period has gone by, the base of the chancroid becomes hard and sclerosed and the sore is transformed into a true chancre which is followed by symptoms of constitutional syphilis.

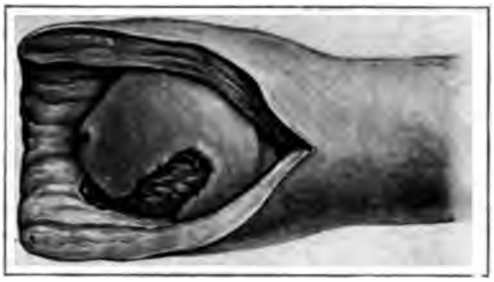

Fig. 300.—Dorsal incision through prepuce to expose chancroids.

## Diagnosis

It is often difficult to make a differential diagnosis between chancre and chancroid, particularly in the cases where an excessive amount of inflammation has occurred and a condition of boggy inflammatory induration is present. We should always bear in mind the possibility of a mixed sore being present, and it is usually well to allow three or four weeks to elapse before excluding syphilitic infection.

The principal points to consider in making a differential diagnosis are as follows:

I. The period of incubation: i. e., the time which elapses between coitus and the appearance of the sore.

II. The *absence* of the cartilaginous induration, which characterizes the primary lesion of syphilis.

III. The ragged punched-out appearance of the sores, which are usually multiple.

IV. The character of the accompanying enlargement of the inguinal lymphatic glands.

Syphilitic glands are always arranged in a chain resembling a rosary, while the enlarged glands accompanying chancroid are in the form of a packet, on account of the periadenitis, which is always lacking in syphilis.

V. The absence of spirochetæ.

VI. A negative Wassermann reaction.

*The bacteriology* of chancroid is rather unsatisfactory from a clinical standpoint. Spirochetæ, of course, are absent, except in the case of a mixed sore, and Ducrey's bacilli are very hard to find because the open wound becomes rapidly filled with all kinds of organisms.

They are best found by causing a fresh chancroid by artificial inoculation and examining the pus from the new sore. Another plan consists in covering the sore with collodion. In twenty-four hours the other bacilli are dead on account of cutting off the supply of air, but Ducrey's bacilli are living and can be found with the microscope. While the base of the chancroid is generally soft, if located in the sulcus coronarius or labia minora of women it is usually quite hard, and it also becomes hard if previously treated by burning with silver-nitrate stick.

As the chancroids develop by autoinoculation a difference in the size of the sores also speaks in favor of chancroid, rather than chancre, which if multiple always develops at the same time.

An acute and painful affection of the lymphatics of the penis and glands of the groin, one side alone being affected, is more apt to accompany chancroid than chancre.

The diagnosis of *chancroid complicated by phimosis* is always difficult unless the foreskin can be retracted sufficently to expose the sore. If marked swelling and redness of the prepuce with painful infiltration and inflammatory hardness of the lymphatics are present together with a discharge of bloody, foul-smelling pus from under the foreskin, the presence of chancroid rather than chancre is to be suspected. The Wassermann test, if not too early in the disease, may settle the diagnosis. If not positive, however, iodide of potassium may be given internally to cause the healing of a syphilitic lesion, but mercury ought never to be given, as it simply masks the character of the infection and delays other manifestations of syphilis upon which the diagnosis can be made later on.

The finding of spirochetæ would, of course, clear up the diagnosis at once, but unfortunately they can not be obtained unless the sore can be exposed, as they do not exist in the discharge and the microscopic examination only discloses ordinary bacteria and saprophytes.

**Herpes preputialis** is sometimes incorrectly diagnosed as chancroid. This mistake ought not to occur if due care is used in the examination. Herpes appears as a number of small vesicles which form upon the glans, prepuce, or skin of the penis. The vesicles soon break, and leave small, round superficial erosions, which rapidly heal under a simple dusting powder.

### Treatment

1. **Abortive.**—If the chancroid is seen early enough, the indication for treatment is to *destroy* the chancroidal character of the sore and transform it into a simple noninfected ulcer.

*Methods.*—Nitrate of silver should never be used for this purpose, as its cauterizing action does not penetrate deeply enough into the substance of the sore.

Fuming nitric acid was formerly much used, but is now abandoned, on account of its unnecessarily severe caustic action.

The best means of destroying a chancroid is by the Holländer hot-air apparatus, followed by scraping it with a sharp curette. Holländer's apparatus is a combination of a Paquelin cautery and an air pump. The air is heated to a temperature of 400° F. and acts as a caustic, but has a selective action and destroys only the diseased portions of the tissues. This is followed at once by curettage with a sharp spoon.

This method is also useful in making a differential diagnosis between chancroid and chancre. The chancroid can be entirely scraped away, but a chancre is so tough that it can not be removed by curetting.

Before using the apparatus, ethyl chloride may be sprayed on the wound, or cocaine injected hypodermatically for the pain.

A very good means of cauterizing a chancroid is by means of the *chloride-of-zinc pulp*, which is easily prepared by adding a few drops of water to chloride of zinc. The pulpy mass resulting is applied to the sores and left on for three minutes. Twelve hours later, hot soaks are used to loosen the crust and the granulating surface is dressed with balsam-of-Peru-silver ointment.

The advantage of the treatment is that all the organisms are destroyed rapidly and completely and the healthy tissue is not injured, as the zinc chloride has a selective action.

If for any reason the chloride of zinc is not used the sores may be touched once daily with tincture of iodine or pure carbolic acid.

It is an error to cauterize every chancroid as a routine measure, and we can lay it down as a rule *never* to cauterize *unless the chancroid* is *free from complications*, as follows:

*Contraindications for Cauterization.*—(*a*) If the inflammation is already excessive and much *inflammatory edema* is present, the irritation of cauterizing will increase it.

(*b*) If *inguinal adenitis* is present, the bubo will be made worse by cauterizing the chancroid.

(*c*) In the case of a *healing cicatrizing chancroid* the chancroidal virus has already disappeared, and cauterization is useless.

(*d*) If a *number* of *chancroids* are *present*, and *only a few are exposed*, the entire number should be destroyed, or none at all, for if any are left untouched they will secrete pus, which will infect fresh surfaces.

(*e*) If a chancroid of the meatus or in the urethra is cauterized, the resulting cicatricial contraction after the sore is healed will produce too much deformity of the parts affected.

2. **The methodic treatment** is carried out by means of:

I. Cleanliness.
II. Antisepsis.
III. Rest.
IV. Heat.

The chancroids should be kept free from the accumulation of discharge by means of frequent washing with solutions of bichloride of mercury 1: 10,000 to 1: 5000, or carbolic acid, 2 per cent, or liquor aluminii acetatis.

Dry dressings or dusting powders should only be used **under the foreskin** and never upon a sore located on the integument. The powder, which is exposed to the air, dries, sticks fast, and forms a scab or crust which prevents the discharge from escaping, and the ulceration extends unnoticed under the dried powder. Whenever the dressing is changed the dried powder adheres to the sore, and, on being pulled away forcibly, tears open the wound, affording fresh points for inoculation or destroying the newly formed epithelium at the cicatrizing edge of the wound.

The best and most efficient powder for dressing a chancroid is iodoform, and nothing has ever been found which will answer the purpose as well.

An objection to iodoform is its odor, but, in many cases of chancroid where inflammation is active and the ulceration is extending, iodoform is the only remedy which acts as a specific and checks the tendency to destruction.

The odor of iodoform can be effectually disguised by using a 10 per cent solution in ether to which a few crystals of cumerine have been added (about gr. ij to the ounce).

The solution is applied to the surface of the chancroid with a medicine-dropper and is quite as active when used in this way as in powder.

In cases where, on account of the objectionable odor, iodoform can not be used, isoform and airol are two recent remedies which have been found to be the most serviceable.

The use of *hot water,* preferably in the form of a sitz-bath for an hour at a time several times a day, is a valuable adjuvant in improving the circulation, lessening the inflammation, and bringing about a reparative action.

A very good substitute for the sitz-bath consists in immersing the penis in a cup of hot water and soaking it, twice a day for an hour at a time. A few crystals of permanganate of potash added to the water have an excellent effect in increasing its healing properties.

When a healthy, granulating surface of the ulcer announces the beginning of the stage of repair it is desirable to discontinue the iodoform, which is only useful as an antiseptic, and dress the ulcer with a mild stimulant like balsam of Peru or the silver-Peru salve of the Charité:

| | | |
|---|---|---|
| ℞ | Silver nitrate | 2 |
| | Balsam Peru | 20 |
| | Vaselin | q. s. ad 200 |

When the chancroid is located upon the integument *wet dressings* are called for. The sore should be dusted with iodoform or europhen and covered with a piece of gauze wet with bichloride solution or liquor aluminii acetatis.

A piece of gutta-percha tissue, to prevent evaporation, should be laid over the gauze and held in place with a bandage.

When the granulations become sluggish, a favorite application in Lesser's clinic is camphor wine or aqua chlori. A bandage is wet in the solution and changed every fifteen minutes.

In the so-called *ulcus elevatum,* in which the granulations have grown up above the level of the skin, it is good practice to cut them off with a razor, apply the Paquelin cautery afterward, and dress with iodoform and a wet dressing.

A *mixed infection with gonococci* sometimes occurs, especially in women.

This condition may be well treated by using protargol solution, 1 per cent, as an irrigation, followed by brushing with 10 per cent nitrate of silver as a caustic, and dressing with bandages wet with 5 or 10 per cent protargol solution.

## COMPLICATIONS OF CHANCROID

The accompanying inflammation may at times become *excessive* from such *general* causes as debility or some dyscrasia, or *local* causes, such as a contact of urine or lack of cleanliness. An excessive inflammation, if untreated, is apt to terminate in *gangrene* and sloughing of the parts.

**Subpreputial Chancroids Complicated by Phimosis.**—When chancroids are located under a long and tight foreskin, the resultant swelling and edema prevent its retraction and render the diagnosis difficult. Artificial inoculation of the patient upon the thigh, with pus from under the foreskin, has been resorted to, to differentiate between chancre and chancroid.

The possibility of the presence of a mixed sore should always be borne in mind in these cases.

### Treatment

The preputial sac may be kept clean by the use of antiseptic injections with a flat-billed syringe under the foreskin, using liquor aluminii acetatis every hour or two, and the penis should be soaked in hot water. An attempt should also be made to retract the foreskin. On account of the danger of paraphimosis, the foreskin should not be left retracted, but drawn back into place.

When the foreskin can not be retracted the balanopreputial sac should be washed out frequently as above described, and in addition a 10 per cent iodoform-glycerin solution should be injected under the foreskin several times a day and held in fifteen minutes. The success of this procedure is brilliant, and since its adoption it is rarely necessary to incise the foreskin (Roscher).

In case the swelling increases and surgical interference is not resorted to, the dorsum of the prepuce becomes gangrenous and sloughs in part, or the entire foreskin sloughs off (spontaneous circumcision), or the glans penis becomes gangrenous and sloughs, either entirely or partially.

If gangrene is threatening, recourse must be had at once to **operative measures.** The prepuce should be slit up, upon the dorsum, with a curved bistoury, to relieve the tension.

After exposing the chancroid, in most cases it is better not to use any cauterizing agents upon the sores or on the fresh-cut surface of the prepuce, as an intense reaction always follows cauterization, which delays the convalescence.

With the above treatment there is very little reaction and the wound is healed and ready for circumcision in fourteen days.

Circumcision should never be performed *in the presence of chancroids* on account of the danger of infecting the wound with chancroidal virus, and converting its entire surface into a chancroidal ulcer.

When *chancroid* of *the frenum* exists, the artery is liable to be ruptured during erection and hemorrhage occurs. To prevent this accident, it is proper to tie a double ligature around the frenum, divide the frenum between the ligatures with a pair of scissors, and cauterize the sore.

**Paraphimosis** is the condition in which a long foreskin is retracted behind the glans, and, from the swelling and edema which take place in it, is prevented from being drawn back into place. Gangrene and sloughing may result, if the condition is left untreated. After prolonged soaking in hot water, an attempt should be made to replace the prepuce, and if not successful multiple punctures will often allow the serum to drain out and relieve the constriction without ulceration.

If these means are not sufficient, the constricting band should be cut upon the dorsum by inserting a curved bistoury under it and cutting outward.

## PHAGEDENA

This the most formidable of all the complications of chancroid, is rarely encountered at the present day.

It is due to debility of the individual attacked, as a result of some dyscrasia, alcoholism, syphilis, tuberculosis, privation, etc., together with an exceptional virulence on the part of the invading organisms.

Three varieties are noted:

(*a*) **Gangrenous.**—The tissues die *en masse*. Probably due to a mixed infection with streptococcus and Ducrey's bacillus.

(*b*) **Phagedenic.**—Does not penetrate so deeply, attacking only the skin; more chronic in its course and *perhaps* an autoinfection, caused by Ducrey's bacillus and fusiform bacilli (Rona, Matzenauer), resembling the organism of Vincent's angina or hospital gangrene.

(*c*) **Serpiginous.**—Caused by Ducrey's baccillus (Rona), perhaps also from gonococci (Thelman).

The serpiginous form is very chronic and lasts a long time, healing at one side and spreading at the other.

**The etiology** of gangrenous, serpiginous, and phagedenic chancroids is not fully understood. It is supposed that they are due to some dyscrasia from excesses, poverty, or alcohol, and that the *exciting cause* is probably a mixed infection with Ducrey's bacillus and streptococcus. In a few cases gonococci have been found. Another view is that the varieties are a form of hospital gangrene of the wounds. In many cases neglect of the chancroidal wound and uncleanliness are responsible for the occurrence ôf this complication. It occurs at times in strong, hearty individuals, and in these cases the cause is entirely unknown.

In the serpiginous form the infective principle remains active for years.

### Diagnosis

It is always difficult to differentiate these conditions from syphilitic manifestations. The best method of making the diagnosis is by watching the effects of a vigorous course of antisyphilitic treatment.

### Treatment

The first indication is to treat the dyscrasia by means of tonics, of which the potassiotartrate of iron in 5-grain doses every three hours is highly spoken of, quinine in tonic doses, and opium for its effect on the pain. Easily digested nutritious food and milk punch should be administered.

In phagedena, either sloughing or serpiginous, *hot baths* are especially valuable. The patient should spend as much time as possible sitting in a tub of hot water which is maintained at a high temperature.

Under the use of the hot water the sloughing often ceases, and the ulcers take on healthy granulations.

In sloughing phagedenic chancroids, after necrosis has occurred, the separation of the sloughing areas is facilitated by the application of hot fomentations.

Iodoform gauze soaked in wine of camphor* is a favorite application in Lesser's clinic. The sloughing variety of phagedena should always be treated very conservatively, and curetting or cauterizing the wound is entirely inadmissible.

In the *serpiginous* form, which is extending active radical treatment is demanded: the diseased area must be completely destroyed by curetting with a sharp spoon, followed by cauterization with the Paquelin or nitric acid and subsequently the free use of an iodoform dressing. Absolute rest in bed is, of course, imperative.

In the serpiginous form the history of an old syphilis can often be obtained, and, while the disease is not a syphilitic manifestation, iodide of potassium internally is often very beneficial. Mercury should not be given, as it is too depressing to the already lowered vital forces.

## BUBO

The term bubo is applied to the inflammatory enlargement of any lymphatic gland, but especially in the inguinal region.

It accompanies chancroid in from 30 to 50 per cent of all cases, and is more common in hard-working men than in women and well-to-do persons, for muscular activity predisposes strongly to its development.

---

*Wine of camphor (German pharmacopeia)

| | |
|---|---|
| Camphor | 1 part |
| Alcohol | 1 part |

Dissolve and add gradually with agitation.

| | |
|---|---|
| Mucil. acacia | 3 parts |
| White wine | 45 parts |

*A turbid white liquid. Shake before dispensing.

### Etiology

It was formerly not known whether the inflammation of the lymphatic glands was caused by the microorganisms formed in the chancroid and carried through the lymphatic vessels or whether it was due to a deposit of toxins in the glands.

It is now known that buboes are caused not by the toxins, but by the presence of Ducrey's bacillus in the glands themselves. Buboes have been incised, their walls scraped with a sharp spoon, and Ducrey's bacillus found. After twenty-four hours, mixed infection occurs and the streptococcus can be identified.

### Course

One gland alone may be infected, but, as a rule, the whole chain on one side is involved, and it is not infrequent for several glands on both sides to be attacked.

The chancroid may be located on the right side, while the bubo occurs on the left side, or *vice versa*, and it occurs most frequently when the sore is located on the frenum or sulcus coronarius.

Exceptionally the involvement of the glands may disappear by resolution, but in the great majority of cases the glands suppurate and break down. The suppuration and softening of the whole gland may run a comparatively rapid course, but, on the other hand, the process of softening of the chain of glands, their breaking down and suppuration, the slow evacuation of the pus through a small opening, may be a very protracted one, and may last for months unless the diseased glands are completely extirpated by surgical measures.

In cachectic individuals, buboes run a very chronic course, and often break down and ulcerate slowly.

Bubo occurs less frequently in women than in men, because women's occupations do not require so much bodily activity.

A common cause of bubo is the frequent cauterization of a chancroid with nitrate of silver. This causes a crust to form over the sore, and the organisms can not escape from the wound; they make their way into the lymphatic glands, and swelling and suppuration are more apt to occur.

After a bubo breaks down and discharges, the wound may become converted into a chancroidal ulceration, either serpiginous or sloughing.

If sepsis occurs, it is due not to Ducrey's bacillus, but to a mixed infection with streptococci.

*Lymphangitis*, or a swelling and inflammation of the lymphatic vessels, frequently occurs as a complication of bubo.

**Bubo d'Embleé** is a term frequently used in France, and is applied to the cases when a bubo occurs without a history of a sore.

It is always caused, however, by a previous sore, which may have healed at the time the bubo first appears.

In making the diagnosis of bubo the possibilities of cryptorchism, or hernia, or enlargement of the inguinal glands, from tuberculosis or carcinoma, should be borne in mind.

The accompanying table indicates the chief points of difference between the glandular enlargement of syphilis and that of chancroid:

## Differential Diagnosis of Bubo and Syphilitic Adenopathy

| CHANCROID | SYPHILIS |
|---|---|
| One side affected, as a rule. | Both sides affected. |
| *Shape* | *Shape* |
| Irregular and boggy. | Regular, smooth, and hard. |
| *Size* | *Size* |
| Large. | Small. |
| *Number* | *Number* |
| May be single. | Always multiple and arranged in a chain. |
| *General Characteristics* | *General Characteristics* |
| Considerable amount of inflammation, causing adherence to overlying skin. Generally suppurate. | No inflammation. Not adherent to skin, but freely movable. Do not suppurate. |
| Packet form. | Rosary form. |

## Treatment

The indications are:

I. To prevent suppuration.

II. After suppuration has taken place, to evacuate the pus and extirpate the diseased glandular structures.

**I. To prevent suppuration,** the most important measure is *rest in bed*, supplemented by the presence of a sand bag over the inflamed gland, together with warm applications.

The ice bag is no longer used, because it has been found that warm applications cause resolution just as well.

Gauze wet with warm liquor aluminii acetatis, applied over the gland, and a sand bag above it, is a suitable dressing.

A favorite method of treating buboes before suppuration, in Lesser's clinic, consists in wearing gauze wet with 95 per cent alcohol, next the bubo covered with nonabsorbent cotton and gutta-percha tissue, with holes cut in it, over all. Alcohol is poured on the dressing twice a day, to make up for the loss by evaporation.

The Bier hyperemia treatment has also been successfully applied to buboes by using a glass bell applied over the swelling for five minutes at a time, with an interval of three minutes, and then a repetition until three applications have been made, and the Bier treatment is also useful after incision of the bubo and evacuation of the pus.

Tincture of iodine painted around the gland, or the following salve rubbed in, is also used in some ambulatory clinics:

| | | |
|---|---|---|
| ℞ | Tinct. iodine | 2 parts |
| | Potass. iodine | 3 parts |
| | Lanolini | 20 parts |

Sig.: External use.

**II. Treatment After Suppuration.**—When fluctuation is noted, the suppuration should be hastened by hot applications, instead of warm.

The thermaphore is very useful in keeping the applications hot in these cases. The hot applications are continued until the gland has fully broken down, and when it is soft all over, and full of pus, a small incision with a double-edged knife should be made, and the pus evacuated. Iodoform glycerin, 10 per cent, is then injected into the cavity. The emulsion should be injected three times at the first sitting. The first two injections run out, and the last one remains in.

The wound is then bandaged with gauze, moistened with liquor aluminii acetatis. On the following day the wound is emptied by squeezing, and iodoform emulsion injected once and left in.

The bandage is then applied, and in five or six days the wound is closed and healed. If after a week the wound is not closed, it should be injected again, and in five or six days the wound has usually healed, and the bubo disappeared.

The method of injecting the wound with silver nitrate is abandoned, on account of the pain which is caused, and because it is no better than the injection with iodoform.

The plan of encouraging suppuration and evacuating the pus through a small incision is satisfactory in most cases when the glands break down rapidly but sometimes the suppuration goes on very slowly, and it is better to make a free incision, evacuate the pus, dissect or curette out the partially broken-down remains of the glands, pack the wound with gauze, and allow it to heal by granulations.

It is better to avoid this if possible, as the subsequent healing takes six or eight weeks, and requires daily dressings.

It was the practice a few years ago to endeavor to prevent suppuration in the glands by making a curved incision over them, dissecting them out, and closing the wound by suture.

This practice has now been abandoned, because it was found that a permanent edema, resembling elephantiasis of the penis and scrotum, and inguinal region, followed in consequence of the obliteration of the lymphatic vessels in the process of wound healing.

Another objection was that, when patients came to operation, suppuration had nearly always begun in the center of the gland, even though no fluctuation was evident; the wound was not aseptic, and could not be closed, but had to be left open, for the slow process of healing by granulation.

In cases when a bubo has broken down, become infected with chancroidal virus, and converted into a **serpiginous ulceration**, the following treatment is a favorite one at the Charité, in Berlin.

It is also useful in old, indolent chancroids, or any chronic ulcerative process.

*Technic.*—The edges and surface of the wound are scraped with a sharp spoon, and afterward seared superficially with the Paquelin. The surface is then brushed over with 10 per cent zinc chloride solution, and a bandage of iodoform gauze, wet with wine of camphor, applied.

As soon as granulations are on a level with the skin, and very little pus is present in the wound, it should be dressed with a nitrate-of-silver salve.

| | | |
|---|---|---|
| ℞ | Silver nitrate | 2 |
| | Balsam Peru | 20 |
| | Vaselin | q. s. ad 200 |

Under this treatment these ulcerations heal satisfactorily.

## CHAPTER XLII

## EROSIVE AND GANGRENOUS BALANITIS

Erosive or gangrenous balanitis is a specific infectious venereal disease which is local, but in severe cases is accompanied with constitutional symptoms. It is caused by a symbiosis of a vibrio and a spirocheta, which organisms are always found together. They have been demonstrated in sections in the blood vessels and inguinal nodes.

### Etiology

The causes which predispose to this disease are:

*First.*—A long, tight foreskin which excludes the air and renders the tissues underneath soft and more liable to infection.

*Second.*—Wetting the labia or penis with saliva, and

*Third.*—Unnatural sexual relations.

The infection is caused by the concomitant presence of a spirillum and a vibrio, which are identical with those producing Vincent's angina and noma. It is possible that a similar infection is the cause of hospital gangrene. The vibrios are curved rods with pointed ends which stain with the ordinary dyes and are Gram positive, but require careful decolorizing with 70 per cent alcohol. The spirilla occur as loose wavy spirals and move rapidly with a quick back and forward snake-like movement. They stain with the ordinary dyes and are Gram negative. The vibriones may be grown on serum agar. They are anaërobic and found in the deeper part of the necrotic tissues, while the spirilla, which are less abundant, are found in the superficial lesions. The spirilla occur normally as saprophytes in the mouth, and the infection probably originates most frequently from the saliva. By themselves, the spirilla are harmless saprophytes and it is only when associated with the vibriones and under anaerobic conditions, or in patients with greatly lowered resistance that their pathogenic effect is exerted.

### Course

The disease shows a preference to locate itself in the sulcus coronarius, or the inside of the prepuce, or on the glans, in the order named. It occurs in a mild or severe form. The inflammatory condition may remain a superficial erosive process and may recover spontaneously in four or five days under appropriate treatment. There may be a good deal of itching and burning behind the glans, which is intensified when the scalding urine comes in contact with it by bulging out the balanopreputial sac. There are no constitutional symptoms.

The severe form is attended with constitutional symptoms, chills and fever, which ranges from 100° to 101°. The phimosis is very marked and so swollen that the foreskin can not be retracted. The infiltration may extend to the root of the penis. In some cases the dorsal lymph cord is palpable and the inguinal glands are enlarged. On retraction of the foreskin, when it is possible, small round ulcers can be seen inside of the erosions, varying in size from a pinhead to that of a pea, with their bases covered by closely adherent false membrane. In other cases the ulcers are more extensive and deeper and as large as a ten-cent piece. These may become confluent and extend over the whole surface of the sulcus or the inner surface of the foreskin. If the case is allowed to go on without treatment the foreskin over the ulcers becomes black, and complete gangrene and necrosis of the part occurs; or if the ulcer is situated on the glans, complete destruction and gangrene of the glans may take place, which may extend even to the root of the penis. In such cases the ulcers are deep, with sharp perpendicular edges, the bases grayish, greenish or brownish, and the penis may show hemorrhagic areas which change into a black necrotic mass.

Both the mild and severe form is accompanied by a foul stinking purulent discharge of grayish-yellow or brownish pus.

## Diagnosis

As the period of incubation is the same in chancroid and in gangrenous balanitis, this condition is liable to be mistaken for chancroid, but the inflammatory reaction, the edema of the prepuce and the degree of phimosis are greater than in chancroid. The diagnosis may be confirmed by microscopic demonstration of the vibriones and spirilla in the discharge and in the tissues.

On account of the enlargement of the inguinal glands which accompanies erosive balanitis, it must be differentiated from syphilis. In syphilis the period of incubation is three weeks, while forty-eight hours are required for erosive balanitis to develop. The dark-field illumination will show the Spirocheta pallida in syphilis and later on the Wassermann reaction will become positive. Herpes preputialis occurs in groups of small vesicles with but little local reaction, and in herpes the organisms characteristic of balanitis are not found.

## Treatment

As erosive balanitis never occurs except under a long foreskin, the practice of circumcision as a preventive should be encouraged. In the mild cases where the foreskin can be easily retracted, all that is necessary is a thorough cleansing and retraction of the foreskin, for as the organisms are anaërobic, the lesions must be so exposed that oxygen can reach them or they can not be controlled. If it is not easy to retract the prepuce, the glans should be exposed by making a dorsal slit through the foreskin. After the glans has been exposed the affected part should be left without occlusive dressings and frequently washed with a 2 per cent solution of hydrogen peroxide. As oxygen is liberated from this compound, it acts as a specific for this form of infection. In severe cases of gangrenous balanitis a 25 per cent solution of peroxide of hydrogen may be painted on the parts if the weaker solutions fail to control it.

An ingenious method of oxidizing the organisms has recently been suggested by Sutton, who uses subcutaneous injections of oxygen by means of an ordinary hypodermic needle connected to an oxygen tank by a small rubber tube, repeated every four hours. The normal tissues surrounding the affected area are first treated and afterwards the involved structures are impregnated with the gas, which has the effect of checking the progress of the disease in six hours and within twelve hours it is completely under control.

### BIBLIOGRAPHY

Corbus, B. C.: Jour. Am. Med. Assn., June 7, 1913.
Morton, F. A.: Jour. Lab. and Clin. Med., Sept., 1917.
Pusey, W. A.: Manual of Venereal Diseases, Surgeon-General, U. S. A., 1917.
Sutton: Jour. Am. Med. Assn., March 9, 1918.

# SYPHILIS AND ITS LESIONS

## CHAPTER XLIII

## SYPHILIS

### HISTORICAL SKETCH

The earliest accounts of syphilis are found in a medical treatise. written in China, 2000 B. C., and a close analysis of the literature of Greece, Rome, the Hindoos and other peoples of antiquity, would indicate that while they did not clearly differentiate syphilis from leprosy, eczema, scabies, etc., still they were familiar with its various manifestations.

Syphilis must have been one of the affections of prehistoric man, since we find the bones discovered in Europe, bearing its traces in the shape of osteophytes or periosteal growths.

The primitive races of the American continent suffered from it as well, as shown by the evidence of their bones found in mounds and burial places; and as an additional proof the chronicles of the earliest European invaders of Mexico describe a disease of the natives which could be nothing else than syphilis.

Syphilis was first definitely studied and described in medical treatises in Europe about the end of the fifteenth century. Attention was attracted to it about the time of the siege of Naples when it broke out in the army of Charles XII, became almost epidemic and spread rapidly through all parts of Europe.

There is very little doubt but that it had always existed in Europe, but had not received any degree of attention by the regular physicians and the treatment had been relegated to the charlatans and those who employed quack silver or mercury, and in this way the term "Quack Doctor," which is in use today, originated.

Another view of its origin which is held by some syphilographers, is that syphilis was acquired in America from the natives by the sailors of Columbus and introduced by them into Europe upon their return home.

The formidable character of the outbreak and rapid spread of the disease, made it imperative upon the leading physicians to study it carefully, with the result that many of the important facts of its natural history soon became a part of medical knowledge.

In the last few years four important facts have been discovered which have entirely changed our ideas in regard to the etiology and treatment of syphilis. These are:

1. The discovery of Spirochetæ pallidum as the cause of syphilis.
2. The possibility of communicating syphilis to animals and its study in apes, guinea pigs, rabbits, dogs, rats and other animals after inoculation.
3. The serum diagnosis of syphilis by the Wassermann reaction.
4. The use of salvarsan in the treatment.

## EXPERIMENTAL SYPHILIS

In 1903 Metchnikoff and Roux established the fact that, in chimpanzees inoculated with syphilitic material, local and, as a rule, also systemic reactions were produced, which resembled the reactions of human syphilis, and from these animals other animals could be inoculated. With the lower apes the local lesions were somewhat less characteristic, but material from these lesions was pathogenic for chimpanzees, like material from human syphilis.

This work was repeated and broadened by Metchnikoff and Roux at the Pasteur Institute, by Neisser, Landsteiner, and Finger, and also by Kraus in Vienna. The results were all in accord with the general observation that higher and lower apes may be infected with syphilis, and that with the higher apes the course of this syphilis resembles the disease in the human subject more closely than does the disease in the lower apes, for in the latter only local lesions result.

With the lower apes the healing of the primary lesion marks the termination of the disease as a rule, but with the higher apes, particularly with the chimpanzees, eight to ten weeks after the inoculation there appear symptoms of a generalized secondary syphilis: macular and papulosquamous exanthemata over the entire skin surface, on the palms of the hands and soles of the feet, and necrotic, sloughing papules on the mucous membranes. That all of these symptoms are truly of a syphilitic nature is proved by the following facts:

1. After inoculation with syphilitic material and after an incubation time which agrees perfectly with that of man, there occurs a complete clinical picture of syphilis.

2. That this affection is contagious for apes and can be further inoculated through numerous generations.

3. That the histologic picture of the primary sore, induration, etc., in apes agrees perfectly with that of man, and that in the tissues of apes, even in later generations, the cause of syphilis, the Spirocheta pallida, can be demonstrated.

It has also been shown that not apes alone are susceptible to syphilis: the introduction of syphilitic material into the anterior chamber of the eye produces, in rabbits, an iritis and a syphilitic keratitis. The spirocheta can be demonstrated in these lesions and material inoculated with positive results in other rabbits. Hoffmann reports similar results in dogs and sheep.

He also showed that the blood of syphilitics, even in the sixth week after the infection, was able to produce syphilis in apes through inoculation; therefore, the blood must contain the syphilitic virus. Also in this connection may be mentioned the infectivity of gummata. Neisser and Finger were able to produce a positive infection in apes after inoculating them with material taken from the periphery of a gumma. Landsteiner and Finger were also able to produce syphilis in apes by the inoculation of semen from a syphilitic man.

In regard to the channel of infection, the primary seat of inoculation in acquired syphilis is almost always a surface covered with squamous epithelium. And for a time it was believed that the spirochetæ could only be introduced into the body in this way.

More recent laboratory experiments on animals, however, prove that syphilis may be artificially produced in animals by introducing spirochetæ directly into the testicle, peritoneal cavity, under the skin, or directly into the circulation especially the heart.

In human syphilis the general infection is usually, but not always, preceded by a chancre on the skin or mucous membrane, but in exceptional cases the chancre may be altogether absent and Neisser is of the opinion that in certain cases infection may take place through the integument without visible or even microscopic changes, the organisms gaining access to the lymphatic or blood stream direct.

This accounts for many of the cases of late syphilis observed in practice where it is impossible to get a history of the appearance of an initial lesion.

As the chancre is forming, a peculiar reaction on the part of the host develops. At first it is so feeble that the individual is susceptible for some time to reinoculation.

In animals it is found that *superinfection* is possible up to eight days before the appearance of the primary sore.

In this way the appearance of multiple chancres may be accounted for; some of these are due to simultaneous inoculation, but others appear successively and are either caused by autoinoculation or contamination with a fresh virus.

The superinfection lesions do not develop in the typical manner of the original chancre, having a shorter incubation and a typical morphology.

During the secondary period the state of resistance to infection, or *anergy*, as it is called, becomes complete and remains so until the patient is cured, when he becomes again in a receptive condition to infection.

The nature of this condition is not understood, and whether it is brought about by the state of the cells or serum, antibodies, or agglutinating substances, we do not know.

## DISCOVERY AND MORPHOLOGY OF SPIROCHETA PALLIDA

In 1905 Schaudinn and Hoffmann discovered two forms of spirochetæ occurring in syphilitic lesions, not only in superficial but also in deep lesions and in the connected lymph glands.

The first form, or Spirocheta pallida, which is now known to be the specific cause of syphilis, is a very delicate spirillum, from four to fourteen microns in length and one-quarter of a micron or less in diameter. It shows from six to fourteen sharp, spiral coils resembling a corkscrew, has bipolar flagella or cilia, and progresses by rotating upon its long axis, and when at rest shows undulatory movements throughout its whole length. There is still some dispute as to its exact biological position, but the weight of evidence seems to be in favor of its belonging to the family of protozoa and not to the bacteria.

The second form, or Spirocheta refringens, which has nothing to do with syphilis, is a coarser organism, ten to fifteen microns in length and one-half to one micron in diameter, with three to five loose coils. It is a constant inhabitant of the mouth and mucous surfaces, and has often been found associated with the Spirocheta pallida.

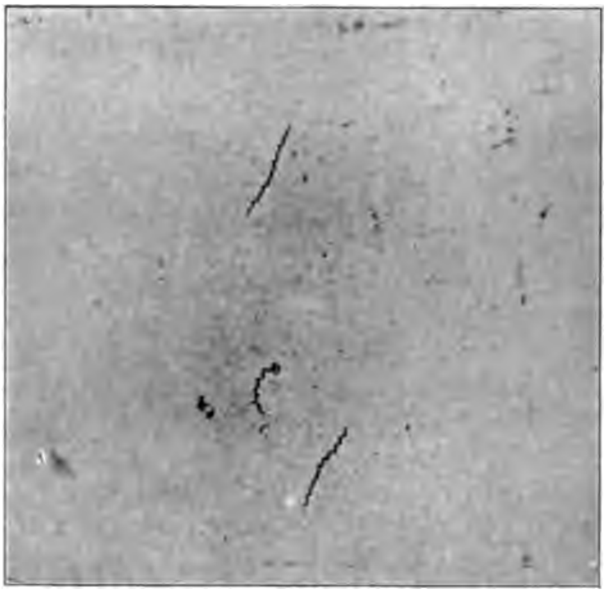

Fig. 301.—Spirocheta pallida. (Courtesy of Hoagland Laboratory.)

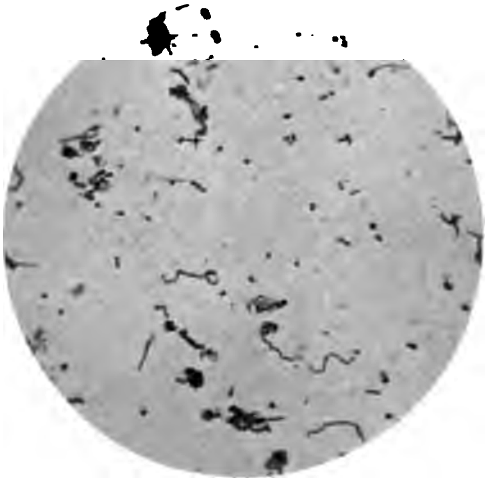

Fig. 302.—Spirocheta refringens.

## OCCURRENCE OF THE SPIROCHETA PALLIDA IN SYPHILITIC LESIONS

The organism may be demonstrated in the expressed fluids of chancres, in the aspirated or spread tissues from the neighboring lymph glands, in the skin of the primary roseola, in all of the secondary cutaneous lesions, in mucous patches and ulcers of mucous membranes, in the sputum when the mouth is affected, and in condylomata. In a few cases they have been found in the circulating blood. According to Hoffmann, the organism is seldom found in the cerebrospinal fluid, and the fluid itself is noninfectious except in very rare cases. The semen of syphilitic men is infectious, but the spermatozoa are not believed to be invaded by the organism. It is more likely to be found in the surrounding fluid.

By Levaditi's silver stain the organisms can be demonstrated in the tissues. In the chancre they are not abundant in the ulcerated surface, but beneath and about it, in and between the epithelial cells, in the subepithelial and perivascular lymph spaces, especially about the growing endothelium of new capillaries, in and beyond the areas infiltrated by plasma cells, and lying within leucocytes and other phagocytes.

In lymph-nodes they are abundant in the peripheral lymph sinuses and in the capsules and trabeculæ. In the internal organs of adults the spirocheta is very scarce, but it has been found in the adrenals, aortic wall, and nerve trunks.

Gummata usually fail to show any organisms, and large quantities of the material are required for successful inoculations. When present at all the spirochetæ are in very small numbers and are located in the hard edge of the gumma.

Hoffmann believes that the organisms enter the lymph spaces of the rete, where they are protected against phagocytosis, or immediately make their way into the lymph vessels of the papillæ. Only after about three weeks, when multiplication has taken place, does a reaction occur. The first changes then would be an endo- or peri-lymphangitis, followed by budding of capillaries, infiltration, and connective tissue hyperplasia. According to the findings of Ehrmann, the lymph vessels are involved secondarily, the earliest changes taking place in the connective tissue interstices, followed by new capillary formation and perivascular infiltration. The evolution and histology of the roseola and papule seem to show that these lesions are embolic rather than toxic.

While the Spirocheta pallida is an extracellular parasite, it suffers extensively from phagocytosis and undergoes progressive intracellular digestion by several types of cells, not only in primary but also in secondary lesions and in congenital syphilis. So prominent and constant is this process that one may safely conclude that phagocytosis is an important if not the chief means of defense on the part of the body against syphilitic infection.

It is only recently that in those diseases called "parasyphilitic affections" such as tabes and general paresis the actual presence of spirochetæ in the brain, spinal fluid, and meninges have been demonstrated.

The researches of Neisser have shown that the spirochetæ leave the infection area very shortly after the inoculation, and invade the surrounding tissues. Neisser, by excising the inoculation sites at different intervals of time, demonstrated that only by excision within twelve hours was it possible to prevent the onset of the disease.

In a later research he showed that the internal organs of monkeys, even during the incubation period, might contain the virus. In the case of the blood the virus was present as early as the fifth day after inoculation, and, in the case of the spleen, the twelfth day.

The actual invasion of the organism is due to the spreading of the spirochetæ along the lymphatic and perivascular spaces. Nevertheless, the blood plays a part in the dissemination of the parasites. It has already been stated that the blood is frequently infective, and, further, that the finding of Spirochetæ pallida in the blood, and the demonstration of the parasites in the blood vessels in primary lesions, as well as in those of congenital syphilis, all point to a generalization of the virus by the blood as well as by the lymphatics.

It has long been known as a clinical fact that certain patients develop syphilitic lesions in the nervous system, while in others the viscera are more apt to be involved, and in still another class the skin manifestations predominate.

The reason for this difference in the behavior of the disease has now been shown by cultural experiments and animal inoculations to be due to differences in the *strain of the spirochetæ.*

Morphologically they can not be differentiated, but the experiments have shown conclusively that certain strains of the organism have a predilection to attack the nervous system, while other strains affect the skin or viscera.

It has also been suggested and is still under experimentation that the refractoriness to treatment of certain patients may be caused by changing conditions in the life cycle of the organisms causing syphilis.

It is supposed that the spirochetæ may lose their spiral form and become inert for a time, resembling spores, which assume again their original form and activity against the body tissues.

While this has not as yet been proved, it may account for the periods of latency and sudden recrudescences in activity which are so characteristic of the course of the disease and may also explain the fact that certain patients suffer from relapses even after the most intensive treatment.

## HISTOPATHOLOGY OF SYPHILITIC TISSUES

**Primary Sores.**—Under the microscope a chancre is found to be composed of a proliferation of the fixed connective tissue cells with a new formation of capillaries around which there is abundant infiltration of plasma cells and lymphocytes.

The miscroscopic tissue changes begin as soon as inoculation occurs and keep on increasing until they become perceptible macroscopically. At first the infiltration is sharply limited, but later it becomes diffuse and more extensive.

The serous discharge from an untreated chancre contains large numbers of spirochetæ, especially after it has broken down, but it is difficult to find them in chancres which have been present some eight weeks or more.

In the early chancres there is an irregular distribution of spirochetæ, and the agglomerations are found in the tissue immediately surrounding the blood vessels, and in the walls of the blood vessels themselves, causing the peri- and endarteritis so frequently seen in these lesions.

They are found in large numbers in the lymphatic spaces, lying with polynuclear leucocytes and in the Malpighian layer of the epithelium before it has broken down.

In ulcerated chancres Spirochetæ pallida are often present in considerable numbers along with forms of spirochetæ and bacteria in the *débris* on the surface.

In chancres of a phagedenic type Spirocheta pallida is often found with difficulty, while large numbers of microorganisms can be demonstrated in the discharge and tissues.

*Lymphatics.*—Spirochetæ pallida are also present in the lymph channels leading from the primary sore, and are abundant in the regional glands, being most numerous in the connective tissue forming the trabeculæ of the gland and in the perivascular tissue, as demonstrated by Levaditi and others.

Roscher found them in the fluid obtained by puncture of the gland thirty times out of thirty-eight attempts.

The spirochetæ enter the lymph glands very soon after infection and before they are large enough to be palpated, since animal experiments have shown them in the testicle and bone marrow before the appearance of the chancre.

*Course of Virus through the Lymphatic System.*—The syphilitic virus pursues the following course, in its progress through the lymphatic vessels into the general blood circulation:

The small round-celled infiltration, which occurs in the chancre, closes up the mouth of the blood vessels and temporarily holds in check the spread of the spirochetæ. The multiple swelling of the lymphatic glands also retards the entrance of the virus into the blood current.

After the virus begins its increase in the chancre, a part of it is carried to the nearest lymphatic gland, which is a favorable spot for its growth and increase. Part of the virus which is deposited here remains and a part travels farther to the next lymphatic gland.

When the chancre is located on the *penis,* the course of the virus is as follows: Through the inguinal glands, lymphatic glands in the abdominal cavity, receptaculum chyli, and thoracic duct, from which it is poured into the left subclavian vein and general blood circulation.

During this time the cervical and axillary glands have had none of the virus passing through them. After the blood has become charged with the virus, they filter out the poison, are infected, and become enlarged in consequence.

**Secondary Lesions.**—The blood stream carries the spirochetæ to every tissue and every normal fluid in the body.

The choroid plexus offers a certain barrier to the invasion of the cerebrospinal fluid, but not invariably so, for spirochetæ have been discovered in the fluid drawn by spinal puncture.

After the first general invasion of the spirochetæ many are destroyed by the natural defenses of the body or by treatment, and those which remain tend to become located in special tissues which react to their presence and lesions occur at these sites with more or less damage to the part affected.

Microscopic examination of a syphilitic papule in the secondary stage shows marked vascular changes, endarteritis being present in many places in the smaller blood vessels, with collections of small round cells in their immediate neighborhood.

The distribution of the spirocheta is very irregular, though it has been found in most of the secondary lesions and they are most numerous in the deeper layers of the epidermis and surrounding capillaries of the papillæ.

The various syphilitic eruptions on the skin are the result of the invasion by spirochetæ of the deeper layers of the epithelial cells of the papillæ and mucous patches; condylomata, orchitis, and various other lesions are the result of injury to the cells by the spirocheta, being deposited at those points.

**Tertiary Syphilis.**—The type of lesion of the tertiary period is the gumma. Microscopically it is found to be composed of an infiltration of lymphocytes, plasma cells, and proliferated connective tissue cells about the vessels, newly formed and old, which are the seat of endarteritis and panarteritis and give rise to giant cells.

Caseous degeneration begins in the center of the granuloma and the necrotic areas liquefy and are absorbed or discharged with the ultimate formation of cicatrices which lead to deformity.

The demonstration of Spirochetæ pallida was unsuccessful as the first attempts in tertiary syphilis, but they were finally found by Spitzer and Doutrelepont and Grauven, and they are known to be present in gummata, syphilitic aortitis, and periostitis.

Schaudinn demonstrated that the spirochetæ are chiefly present in the periphery of the necrotic areas.

In sections of the livers of children dying from congenital syphilis, gummata are found in all stages. In the very early stage of the gumma spirochetæ are found in the wall of the blood vessels as well as within the surrounding cellular infiltration, but, as soon as the artery becomes obliterated and degeneration sets in, the spirochetæ also degenerate and disappear.

## IMMUNITY IN SYPHILIS

Immunity may be defined as *the condition of body which resists the growth and pathogenesis of disease-producing germs.*

As to whether a certain degree of immunity acquired by heredity exists is still a matter of dispute, although it is a fact that when syphilis is transported into a community where it had been previously unknown its course is very virulent and severe.

It was formerly supposed that one attack of syphilis protected the individual against subsequent attacks and an immunity existed throughout the patient's life.

This has now been disproved and it is known today that a second fresh infection with syphilis in the same individual is possible; the second infection can only occur after many years, and its course is milder than the original attack.

Another interesting fact which animal experimentation has brought out is the phenomenon of superinfection.

*Superinfection* in syphilis is the contraction of syphilis by an individual before he has recovered from the first attack and while the spirochetæ are still present in the body. It is only possible to reinoculate a syphilitic individual with syphilis during the time before the appearance of the chancre and for a period of from fifteen to thirty days after its appearance. From this time until after the patient is cured, that is, until the spirochetæ are all destroyed and the Wassermann reaction is permanently negative, the individual is no longer capable of being reinoculated with syphilis.

After this time his immunity disappears and he becomes again susceptible to infection.

A form of *passive immunity* which is sometimes observed occurs in children apparently healthy, and who remain so for some time, who are born of syphilitic mothers. It is supposed that in these cases the fetus *in utero* may be partially immunized by the passage of dissolved substances (antibodies) across the placenta from the mother.

As to the cause of immunity we are still in the dark. Neisser believes that complement-binding and agglutinating substances of a specific nature are formed, which neutralize or destroy the spirochetæ, while Levaditi suggests that their destruction is caused by the formation of antibodies. It is known that bacterial action and growth produce substances called *toxins*, which are poisonous. It is supposed that another set of chemical substances, called antibodies, is being formed at the same time, which either destroy the spirochetæ or exert some action on the tissues of the body which causes them to be insusceptible to the action of the microorganisms of their toxins.

## SYPHILIS AND IRRITATION

It was formerly difficult to account for the predilection which the lesions of the tertiary period seemed to show for certain structures. It is now known that after the first overwhelming of the system by the spirochetæ they are deposited in certain parts of the body, especially the brain, nervous system, tongue, skin, and periosteum, where they remain latent often for many years, until awakened to activity through irritation or excessive use of that part of the body.

Frequent examples of this fact have long been observed in practice, as, for instance, the effects of smoking, or the friction from broken teeth in causing sores in the mouth. Pressure contact, if oft repeated and prolonged,—as, for example, the pressure of the forearm upon a desk, in a clerk or bookkeeper,—predisposes to the appearance of an eruption upon the skin of the forearms. A slight blow or squeeze may induce the formation of gumma in the bones or testicles, and, as would naturally be expected, the bones which lie near the surface of the skin—such as the tibia, ribs, and skull—are more apt to be affected by periostitis than the bones which are abundantly covered by a thick cushion of muscle and fat.

On account of the presence of spirochetæ in the tissues, relapses affect the point of least resistance in the body. Thus, for instance, syphilis of the liver is more frequent in alcoholics than in abstemious persons, and syphilis is particularly liable to attack the brain and its meninges in individuals who are mentally active and are brain-workers. For the same reason a relapse of a syphilis which has been latent for some time is often induced by an attack of malnutrition brought on by want and privation.

## METHODS OF EXAMINATION FOR SPIROCHETÆ

### Obtaining Material for Examination

1. *Irritation Serum Method.*—This method can be used for examining eroded efflorescences, such as the primary lesion, condylomata, and ulcerating syphilides.

The ulcerated surface is first cleansed with physiologic salt solution and dried with sterile gauze. The surface is then rubbed with sterile gauze or lightly scraped with a platinum spatula, until the serum flows abundantly, always avoiding drawing blood.

The flow of serum is facilitated by squeezing the sore between the finger and thumb. The serum is then placed upon a glass slide. The spirochetæ can be examined living or stained.

2. *Suction Method.*—The serum can also be obtained after cleansing the sore by placing a Bier hyperemia cup over it. After a few minutes clear serum is obtained which is placed upon the glass slide. All other methods, such as excision of the chancre or papule, puncture of the glands, and examination of the blood sediment, have no value for diagnostic purposes, and are only used for an experimental object.

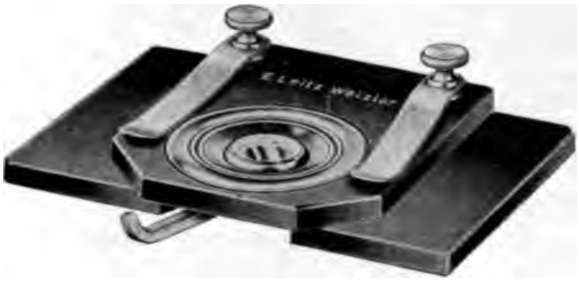

Fig. 303.—Reflecting condenser for dark-field.

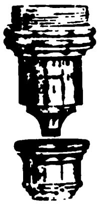

Fig. 304.—Tube and funnel necessary to use with oil-immersion objective.

## DEMONSTRATIONS OF THE LIVING SPIROCHETA PALLIDA

*Preparation of the Specimen.*—After a drop of the serum is placed upon a glass slide, which has been thoroughly cleansed with alcohol, it is carefully covered with a cover-glass.

*Dark-field Illumination.*—For observing the living spirochetæ the method of dark-field illumination is the one to be preferred; and is now generally used, for the organisms appear very distinctly as pale white, undulating bodies against the dark background.

A great advantage in examination by the dark-field is that there is no distortion of form or size, and the movements can be watched.

An intense source of light is requisite, and the microscope must be provided with the funnel-shaped condenser, inside of the oil-immersion lens, as well as the dark-field condenser.

Before placing the slide under the microscope a drop of cedar oil is put on top of the slide and another drop of cedar oil underneath it. The specimen is then examined with the oil-immersion lens.

*India-ink Method of Burri.*—1. A drop of the fluid to be examined and a drop of fluid india ink are placed upon a glass slide and mixed together with a platinum loop.

2. The preparation is dried in the air.

3. Examined with the oil-immersion lens.

The spirochetæ appear light against the dark background, and can be recognized by their form, undulations, and length.

Sterilized Chinese india ink must be employed and, before using, it is to be diluted with distilled water 1:10.

The india-ink method is simple and requires no special instruments.

*Demonstration in Smears on a Glass Slide by Fixation and Staining.*—These methods formerly in general use have been at the present time generally discarded in favor of the dark-field illumination.

The staining may be employed as follows:

The serum must be smeared with a platinum loop in the thinnest possible layer upon a glass slide and dried in the air.

The most common method of staining is by the Giemsa method, as follows:

**Giemsa Method.**—The preparation is allowed to dry in the air and then fixed by carefully passing through the flame. In a clean test tube, previously rinsed with hot alcohol and then with distilled water, place 10 c.c. of a 0.5 per cent watery glycerin solution, and add 13 drops of Giemsa's solution (Grübler). Mix thoroughly, heat to boiling, and if no precipitate appears pour on the slides, allowing it to remain for three minutes. Then pour off the stain, rinse the preparation in distilled water, and apply the stain again (a third time if necessary) as above. When sufficiently stained the film appears a deep pink with a slight metallic luster when dry. Rinse in water. Dry without heating, add a drop of cedar oil, and examine directly with a one-twelfth immersion lens. The Spirocheta pallida appears an intense pink. The Spirocheta refringens of balanitis and other nonspecific lesions stains equally well, but may be distinguished by its greater thickness and by its wavy convolutions.

(For other methods see Appendix.)

## ANALOGY BETWEEN SYPHILIS AND THE ERUPTIVE FEVERS

A distinct parallel, which has been pointed out by Jonathan Hutchinson, exists in the course of syphilis and smallpox, measles, scarlatina, etc. All these diseases are due to a special and distinct poison, which is introduced into the body. After a period of incubation, during which the virus increases in volume, its quantity becomes so great that the organism is saturated with it, and constitutional symptoms occur. Each disease runs its own definite and self-limited course, and afterward a condition of immunity follows, which lasts for a longer or shorter time.

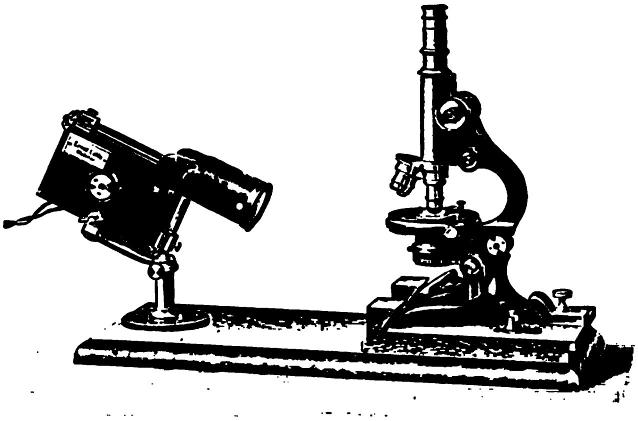

Fig. 305.—Arrangement for lighting the dark-field with electric light.

**The modern view of syphilis** is that it is an overwhelming of the entire body occurring at the beginning of the secondary period by the spirochetæ, which remain in the tissues that offer a suitable pabulum for them.

In most of the situations to which they gain access they are destroyed either by the effects of treatment, the formation of antibodies, or phagocytosis, but in some places they remain without increase until an irritation occurs, causing them to increase in numbers and form a lesion at the point of deposit.

All the early secondary relapses and the late tertiary ones as well, such as tabes, cerebral and visceral syphilis, are today known to be the result of spirochetæ that have remained latent in the organs affected from the time of the original infection.

## INOCULATION AND COURSE OF SYPHILIS

Fournier describes the course of a case of syphilis as a drama or tragedy, with acts and pauses, and represents its course graphically by the following diagram:

After inoculation with the virus of syphilis no symptoms are observed at the point of entrance or elsewhere for a period of *at least three weeks.*

It is supposed that at this time the spirochetæ are too few in number to cause any reaction of the tissues, but, as they increase in number, they induce a condition of local irritation, and the chancre appears. The virus continues to increase, is taken up by the lymphatic vessels and carried to the nearest lymphatic glands, which serve as incubating places for the microorganisms. The glands undergo enlargement successively, and ultimately the virus reaches the general blood circulation.

When saturation of the blood has occurred, the fact is announced by prodromata, which are soon followed by an eruption on the skin and mucous membranes. Later the eye, periosteum, and viscera are attacked by inflammatory changes, consisting of arteritis and small round-celled infiltration.

The eruption remains upon the skin for from four to six weeks ordinarily and then disappears, and for a time no symptoms of the disease are present. This interval in the manifestation is spoken of as a period of latency.

By a **period of latency** is understood today to mean only that manifestations of the disease are not visible on the skin or mucous membranes, but the spirochetæ are still present in the body.

Relapses followed by periods of latency occur at intervals of from three to six months during the entire course of the disease, and it is noted that relapses are more apt to take place in patients who have had little or no treatment.

In the majority of cases which receive systematic and adequate treatment relapses cease after from one to three years. But it does not necessarily follow that the syphilis is at an end because a considerable length of time passes without a relapse. After a period of latency, which may extend over many years, new symptoms may again develop.

The *late lesions* differ from the early ones, in that they are of a grave nature and do not tend to spontaneous recovery, but are more apt to destroy the organs attacked. The secretion which they furnish has also lost its contagious properties.

## STAGES OF SYPHILIS

It is found convenient to divide the regular course of syphilis into three stages, as follows:

I. **Primary stage,** which includes the time from the moment of infection to the outbreak of the general symptoms (eruptions and mucous patches, etc.), and which lasts from eight to ten weeks.

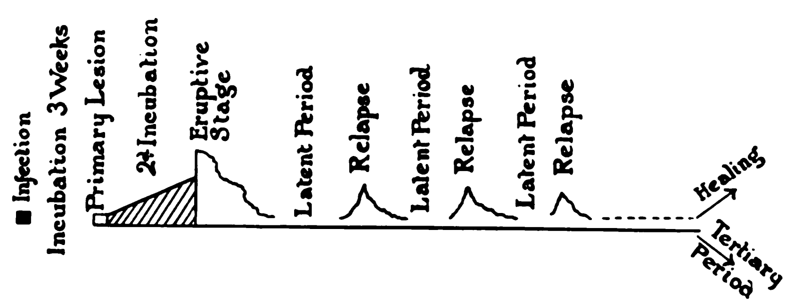

Fig. 305.—Fournier's syphilis curve.

For the first three weeks of the primary stage there are no obvious symptoms to indicate that the individual contains spirochetæ in his tissues, although they can be found microscopically. At the end of three weeks the chancre appears, and the adjacent glands become enlarged and are the only signs of infection.

II. **The secondary stage** begins when the eruption, alopecia, and mucous patches make their appearance. It is the stage of typical and regular development of eruptions, their accompanying symptoms and periods of latency alternating with relapses. The secondary stage lasts from six to eighteen months, or about one year on the average.

III. **The tertiary stage** comes on after a prolonged period of latency, and is the stage of formation of gumma. The tertiary stage may never occur. Its secretions are not contagious, and it resembles a *diathesis* more than an active disease, for although spirochetæ are present they are few in number.

## INCUBATION

**Definition.**—The period of time which elapses after the spirochetæ have entered the body until the first manifestation of their working appears is the incubation period. The poison is not inactive during this time, but increasing in quantity.

The primary stage of syphilis is divided into two periods of incubation:

(*a*) *Period of primary incubation,* which is the period from the time of infection until the chancre appears. The chancre represents the reaction of the tissues in consequence of the local increase of the virus.

(*b*) *Period of secondary incubation* is the time from the appearance of the chancre until the eruption is seen. The eruption indicates that the blood is saturated with the virus.

## GLANDULAR ENLARGEMENT

The lymphatic glands are supposed to act as places for the incubation, growth, and development of the syphilitic virus, and to serve as storehouses for it, during the entire secondary stage. The glands nearest the chancre begin to enlarge about four weeks after infection.

**General Characteristics.**—The glands become:

(*a*) Firm and hard, arranged in a chain, resembling a rosary.
(*b*) Freely movable under the skin.
(*c*) No pain.
(*d*) Rarely suppurate except in strumous or weak patients.

The glands nearest the chancre become enlarged first; consequently we find that, when the chancre is located on the *penis,* the *inguinal* glands enlarge first; when the seat of the chancre is on the *breast,* the *axillary* glands are the first to become affected; and if the chancre is located on the tongue or lips, the *submaxillary* glands are first attacked.

After the syphilis has become general, all the lymphatic glands throughout the body are enlarged, and when located superficially are easily felt.

For diagnostic purposes, the enlargement of the paramammillar and postauricular glands is the most reliable.

The epitrochlear and postcervical glands are less to be depended upon, as they may enlarge from other causes.

As a general rule the glandular swelling disappears in the tertiary period, i. e., two or three years after infection.

The **lymphatic vessels** lying between the glands often become hard and indurated, feeling like cords, and this condition is called *lymphangitis.*

### BIBLIOGRAPHY

Buret: Syphilis in Ancient and Prehistoric Times, 1891.
Editorial: Med. Rec., Dec. 28, 1912.
Fordyce, John A.: Am. Jour. Med. Sc., June, 1915; New York State Jour. Med., Nov., 1915.
Gordner, Faxton E.: Med. Times, May, June and July, 1916.
McIntosh and Fildes: Syphilis, 1911.
Neisser: Pathologie und Therapie der Syphilis, 1911.
Nichols, Henry J.: Jour. Am. Med. Assn., Jan. 11, 1913.
Reasoner, M. A.: Jour. Am. Med. Assn., Dec. 16, 1916.
Wile, Udo: Jour. Am. Med. Assn., Feb. 26, 1916.

# CHAPTER XLIV

## CHANCRE

**Synonyms.**—Initial lesion of syphilis; initial sclerosis; hard chancre.

**Definition.**—Chancre may be defined as the first manifestation of the syphilitic poison at the seat of its entrance into the body, and is due to the reaction on the part of the tissue against their invasion by the Spirocheta pallida.

The spirochetæ which are inoculated into an individual and cause the chancre are derived from the secretions and broken-down *detritus* formed in:

(*a*) A chancre in another person.
(*b*) Mucous patches.
(*c*) Condylomata.
(*d*) Blood.
(*e*) Lymph.
(*f*) It was formerly thought that the *physiologic secretions* did not contain the syphilitic virus, but recent investigations have shown that in exceptional cases they do contain the poison.

### Course

When the spirochetæ are first inoculated under the skin, they are too few in quantity to produce any symptoms. But the poison increases in amount, and, after three or four weeks have passed, the quantity is so great at the point of inoculation that the tissues react, and the chancre appears.

But the spirochetæ have entered the blood stream even before the appearance of the chancre, for they have been found by animal experiments in the bone marrow and testicle before the chancre is evident and Truffi has found them in the lymph nodes one and two weeks after inoculation.

The pus from a chancre, unlike that formed in a chancroid, has not the property of destroying the epidermis, and in order to produce a chancre it is necessary that the poison from a syphilitic lesion be introduced through an *abraded surface.*

This fact explains the cases in which a physician attends a syphilitic woman in confinement or a man has coitus with a woman who is affected with condylomata or a chancre, and, if an abrasion did not exist at the time of contact, inoculation does not occur.

The solution of continuity may be microscopic in size, however, but still large enough to permit the spirocheta to enter directly into the blood or lymph streams. If a small number of organisms are inoculated under the skin, it may be possible for them to increase in numbers and infect the entire body without the appearance of a chancre at the initial point of inoculation.

This may be an explanation of the rare cases of undoubted syphilis one meets with in practice where a chancre has never preceded the constitutional disease.

### Transmission of Contagion

The methods by which the contagion is transmitted may be classified as:

(*a*) Direct.
(*b*) Indirect, or mediate.
(*c*) Inheritance.

By *direct contagion* we understand those methods in which the syphilis is inoculated by *personal contact,* such as coitus, kissing, surgical operations, a syphilitic child infecting its wet-nurse, or a healthy child acquiring syphilis by nursing from a syphilitic wet-nurse.

In *indirect,* or *mediate, contagion,* the disease is conveyed through the medium of some article which has been infected with the virus of syphilis, such as a spoon, pipe, cup, or cigar used by a person with mucous patches in the mouth; an instrument used for tattooing, dental, or surgical operations which has been used on a syphilitic individual and was not cleaned afterward, the tubes used in common by glass-blowers, or by means of underclothing or a bathing-suit which was stained with secretions from syphilitic lesions. According to Fournier's statistics from 1,124 cases of extragenital chancre we have the following data:

FOURNIER'S STATISTICS

| | | | | | |
|---|---|---|---|---|---|
| Cephalic region | 849 | Mouth | 729 | Lips | 567 |
| | | | | Tongue | 75 |
| | | | | Tonsils | 69 |
| | | | | Gums | 11 |
| | | | | Palate | 4 |
| | | | | Mucosa of cheek | 1 |
| | | Face | 119 | Chin | 54 |
| | | | | Cheek | 24 |
| | | | | Eye | 21 |
| | | | | Nose | 18 |
| | | | | Forehead | 2 |
| | | Scalp | 3 | | |
| Upper extremities | 70 | | | | |
| Anus and perineum | 78 | | | | |
| Breasts | 5 | | | | |
| Trunk | 33 | | | | |
| Lower extremities | 14 | | | | |
| Cervical region | 14 | | | | |

*Choc en retour.*—It was formerly supposed that a healthy woman having connection with a syphilitic man might escape infection with syphilis, but becomes pregnant, and later become infected with syphilis from her own child *in utero.*

Observations with the Wassermann reaction, however, have shown that this is not the case, but that the mother was syphilitic from the beginning, but showed no manifestations until after the child's birth.

**Vaccination chancre** in former years was not uncommon, and was caused by vaccinating with an instrument which had previously been used to vaccinate a syphilitic individual, and which was not afterward cleansed, but was used still contaminated with the syphilitic virus.

Chancres were also produced by vaccinating with dried lymph crusts, which had been taken from vaccine-vessels produced in an individual who was also affected with syphilis at the same time.

At the present day animal vaccine lymph, taken from the calf, is used exclusively, and as cattle are not affected with syphilis, a chancre as the result of vaccination never occurs.

The **location of the chancre** depends, of course, upon the point at which the spirochetæ are inoculated. The chancre appears most frequently on the genitals, but may be on the lips, tongue, breast, or fingers. It begins as a papule or small tumor, which increases in size; the surface becomes eroded, or ulcerated, and furnishes a secretion which after the first few days have passed is not autoinoculable. The most characteristic feature of the chancre after the presence of Spirochetæ pallida is the **induration of the base,** which is caused by a deposit of small round cells in the tissues underlying the chancre, and also by inflammatory changes in the blood vessels and lymphatics.

## Pathology

On microscopic examination of a section from a chancre, the findings are as follows:

I. **A small round-celled infiltration of the skin and subcutaneous tissues** such as occurs in every inflammation. The latest investigation of the pathology of chancre shows that the *lymph vessels* are primarily affected with an inflammation of their inner coats. The affection is particularly marked in the lymph vessels which accompany the vasa vasorum. The *media* of the arteries are secondarily attacked and finally *endarteritis* occurs.

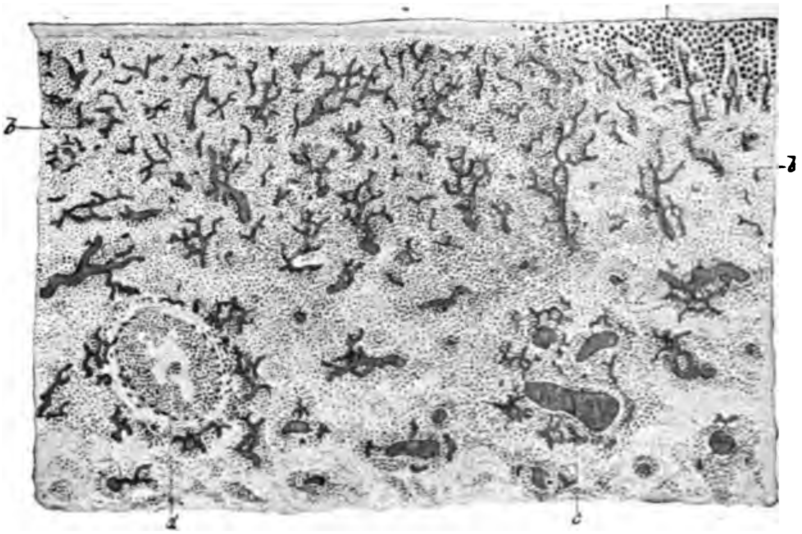

Fig. 307.—Section of a chancre (injected). *a*, rete mucosum; *b*, small round-celled infiltration with numerous injected blood vessels; *c*, blood vessels with endo- and periarteritis; *d*, lymphatics with adventitial and endovascular changes.

The changes in the arteries are more apparent than those in the lymphatics, and for that reason the alterations in the lymphatics were overlooked by the earlier observers.

At the same time there is a formation of great numbers of new **blood vessels with stasis in the new venules from pressure of the** cells often associated with hemorrhages and the formation of blood pigment.

II. **Changes in the Blood Vessels.**—The veins and arteries are both affected by the endarteritis, but the changes are more marked in the arteries. The inflammatory process begins in the vasa vasorum and extends from there to the accompanying vessels, attacking the adventitia, media, and ultimately the intima.

The endothelial cells of the inner coats of the vessels are swollen and the lumen is diminished. The middle coat is usually slightly thickened and infiltrated, but the important change is in the outer coat, which is the seat of an infiltration with small round cells.

**III. The Presence of Spirochetæ.**—Spirochetæ can be demonstrated in a chancre at its first appearance, but it is often difficult to find them after eight weeks have elapsed.

They exist in agglomerations in the tissues immediately surrounding the blood vessels and in their walls, occasioning the endo- and periarteritis characteristic of the lesions. They are found in large numbers in the lymphatic spaces, in the lymph channels leading from the primary lesion, and in the adjacent connective tissue, often at a remote point from the sore.

In consequence of all the changes described, the circulation of blood is shut off, and coagulation necrosis, with sloughing of small areas of tissue supplied by the affected vessels, takes place.

It is desirable to understand clearly the pathologic changes, since all syphilitic lesions—including chancre, papule, and gumma—are identical, and are due *primarily* to endarteritis and *secondarily* to the accompanying round-celled infiltration.

In rare instances an *endolymphangitis* occurs, which obstructs the flow of lymph, and occasions a hard, boggy condition of the tissues, causing the so-called *indurative* or *sclerotic edema*.

The **hardness** and **sclerosis** of chancre are accounted for by the microscopic findings.

In the early stages the small round-celled infiltration is circumscribed and sharply limited, while the infiltration is diffuse and much more extensive both on the surface and in the depths.

The essential characteristics are always the same, but chancres vary considerably in outward appearance, as, for example:

(a) In the amount of induration.
(b) In the depth of ulceration.
(c) In the amount of inflammation of the surrounding tissues.

Therefore chancre is grouped in several varieties.

The form of the chancre differs, depending upon the anatomical part upon which it is located, and also upon the course and situation of the blood vessels.

When they run horizontally and near the surface, a thin, flat layer of infiltration occurs under the skin, which is called **parchment induration.** On the other hand, when the blood vessels dip down deeply into the tissues, the induration is extensive and deep, and is called **Hunterian induration.**

For example: inside the prepuce, the parchment chancre often occurs; in the sulcus coronarius, a heavy mass of infiltration takes place, forming a Hunterian chancre; on the frenulum, a thick string occurs; and on the glans, a flat erosion.

## Varieties

I. *Dry papule,* made up of a very slight amount of induration.

II. *Hunterian chancre.* In this variety, which is named after John Hunter, a considerable amount of induration is present. Its central part is the seat of a coagulation necrosis, from the endarteritis which occludes the blood vessels and causes a depression in the center, which is funnel-shaped, or like the crater of a volcano. The Hunterian chancre is the form most commonly met with.

III. *Parchment chancre.* This form is due to a superficial layer of infiltration lying immediately under the skin and widely spread out in the tissues. It feels like a piece of parchment on being pinched up between the fingers.

IV. *Indurative or sclerotic edema.* This condition is produced by a combination of the usual endarteritis and small round-celled infiltration. It is accompanied by an inflammation of the lymphatic vessels or endolymphangitis, and usually occurs on the female genitals.

The circulation of the lymph is interfered with, and it transudes from the lymphatic vessels into the tissues. This combination of pathologic changes gives rise to a boggy condition of the tissues, which is harder and more pronounced than in simple edema, and, on being pinched between a finger and thumb, a condition of *fibrosis* is felt. Indurative edema is a rare condition, but occurs more frequently on the female genitals than in men.

## Chancre Heals Without Leaving a Scar

The ulceration and necrosis of the chancre take place at the expense of the newly formed tissue elements, rather than the normal structures of the parts affected, and consequently no scar results. Chancroids always leave a scar after healing, because the ulceration spreads and destroys normal fixed cells of the part.

### Duration of the Chancre

A chancre may heal in a few days or may remain unhealed for many months, especially if it is located under the prepuce and provided no salvarsan or mercury is given.

## CHANCRE OF THE URETHRA

Chancre situated *within* the urethra is a rare condition, but it does occur at times. It is usually located from one-half to one inch from the meatus, and the only symptom which it occasions is a thin discharge from the urethra, which may be easily mistaken for a gonorrhea. Examination, however, shows a hard, sclerotic mass surrounding the urethra under the skin, and the nearest lymphatic glands are also enlarged.

A knowledge of the fact that a chancre may be concealed within the urethra will sometimes be of service in explaining the cases of syphilis in which the patient admits having had a slight gonorrhea, but who denies that he ever had a chancre. In these instances the discharge from the chancre, issuing from the meatus, was mistaken for a urethritis.

### Diagnosis

The discovery of the Spirocheta pallida as the cause of syphilis has placed in our hands a means of recognizing at once, in most cases, the nature of a suspicious sore, and it is now no longer necessary to follow the former practice and wait for the appearance of secondaries in order to make a diagnosis.

A microscopic examination of the serum obtained from the sore, preferably with the dark-field illumination, will show the living spirochetæ in full movement, and with a reasonable amount of practice they are easily differentiated from the other nonspecific forms of spirochetæ, by their shape and the character of their movements. For this reason the examination by the dark-field illumination is to be preferred to the various staining methods, for with the latter the movements of the organisms are lost and differentiation is much more difficult.

When the method of examination for spirocheta is not available, as, for instance, in a chancroid where there is a suspicion of a mixed infection, or in a sore underneath a long prepuce, which renders it inaccessible, or in remote places in the country, where the diagnostic opportunities of laboratories are not available, it is necessary to wait before making the diagnosis for secondary symptoms—i. e., eruption, mucous patches, alopecia, fever, and headache—to confirm it, or we can make the diagnosis by confrontation.

**Diagnosis by confrontation** is made by examining the individual from whom the patient acquired the sore, in order to determine the presence or absence of syphilis.

The Wassermann reaction as a rule is not available so early in the disease; so that it can not be depended upon for its assistance in making the diagnosis during the primary stage of syphilis.

**The most reliable diagnostic points of chancre** may be summarized as follows:

I. The presence of *Spirochetæ pallida.*

II. Indolent painless swelling of the nearest lymphatic glands, which are polyganglionic. i. e., arranged in a chain.

III. Induration of the base of the sore, which consists of a hard, cartilaginous induration, and feels like a foreign body imbedded in the tissues.

IV. History of the period of incubation, lasting about three weeks.

## Differential Diagnosis Between Chancre and Chancroid

| CHANCRE | CHANCROID |
|---|---|
| *Organism* | *Organism* |
| Spirochetæ pallida. | Ducrey's bacillus. |
| *Incubation* | *Incubation* |
| Three weeks. | Two to three days. |
| *Commencement* | *Commencement* |
| Begins as erosion or papule, which undergoes superficial ulceration. | Pustule or ulcer, and remains so. |
| *Numbers* | *Numbers* |
| Single generally. If multiple, usually so from beginning. | Multiple from beginning or becomes so by autoinoculation. |
| *Edges* | *Edges* |
| Level or sloping and adherent, giving "scooped-out appearance." | Abrupt and undermined. |

| | |
|---|---|
| *Floor* | *Floor* |
| Smooth, shining, red, or raw; covered with slight deposit. | Rough; worm-eaten; "wash leather" in appearance; yellow exudate. |
| *Secretion* | *Secretion* |
| Scanty; slightly purulent; not autoinoculable after 15 days. | Abundant and purulent; autoinoculable with ease. |
| *Progress* | *Progress* |
| Slow. | Rapid. |
| *Induration* | *Induration* |
| Constantly present. Cartilaginous. | None or boggy. |
| *Pain* | *Pain* |
| Absent. | Painful and inflamed. |
| *Bubo* | *Bubo* |
| Constantly present. (See table in section on Bubo.)<br>Rosary form. | Occurs in 1 out of 3 cases.<br>Packet form. |
| *Scar* | *Scar* |
| Heals without scar. | Scar always remains. |

The *Holländer hot-air apparatus* is useful in making a differential diagnosis between chancre and chancroid.

After being treated with the hot air, a chancroid can be easily removed with a sharp curette, while a chancre is so dense and firm that it can not be scraped away.

Carcinoma may be differentiated from chancre by its slow growth and absence of constitutional symptoms. The inguinal glands in carcinoma enlarge later in the disease.

A gumma of the glans presents great difficulties in the way of diagnosis. The chief differential point, however, is that enlargement of the inguinal glands is not present, and the Wassermann reaction is positive in the case of gumma, while in the presence of a chancre it would be too early in the disease to get a positive Wassermann.

In the presence of a chancre with a phimotic foreskin, the chancre can be felt under the skin.

In women it is often difficult or even impossible, to find the chancre among the folds of the labia.

When an extragenital chancre is present, the nearest lymphatic glands are irregular and are often in the form of "packets," the extreme enlargement being due to mixed infection.

## Prognosis

It may be stated, in a general way, that the severity of the chancre bears some relation to the gravity of the secondary manifestations. When the chancre is benign, it is probable that the secondary lesions will be superficial and of a mild type, which can be explained in the following way: In a debilitated individual the tissues react more violently to the syphilitic poison, and consequently both chancre and secondaries are more severe, while, on the other hand, the tissues of a vigorous, well-nourished person are in better condition to resist the action of the poison.

The type of chancre, however, is no indication as to the severity of tertiary lesions, and the severest tertiary accidents often follow a mild chancre.

This is sometimes, no doubt, due to the fact that treatment is often neglected or insufficient in mild cases.

## Treatment of Chancre

No local treatment should be applied to the chancre until the examination for spirochetæ has been made, for calomel, iodoform, or any other antiseptic destroys the organisms and falsifies the diagnosis.

The cardinal rule in the treatment of chancre is to *avoid every form* of *irritation;* caustics, strong applications, or mechanical irritants should never be used.

When the chancre is located on the **integument**, a *moist dressing* should be used, consisting of a piece of cotton gauze, soaked in liquor aluminii acetatis, black wash (calomel and lime water), Thiersch's fluid, or bichloride solution 1:2000, and covered with a piece of guttapercha tissue or oiled silk to prevent evaporation.

If the chancre is located **beneath the prepuce**, a simple dusting powder of calomel powder, which is covered with cotton, forms a suitable dressing that absorbs the discharge and prevents the open sore from being infected with pus organisms, and when the chancre is ready for absorption, *mercurial plaster* is a useful application, as the local contact of the mercury with the chancre hastens its disappearance.

When much ulceration is present, iodoform may be used to advantage.

For a *chancre of the tonsil* the best remedy is a daily brushing with a 1 per cent sublimate solution.

A primary lesion on the lip, while moist and secreting freely, responds well to applications of liquor of aluminii acetatis, and, after it is dry and beginning to heal, an ointment of hydrarg. precip. albæ, 10 per cent in vaselin, is useful; and later when only the induration is left, mercurial plaster may be used as an absorbent.

## Prophylaxis against Syphilis

In the course of their experiments on monkeys Metchnikoff and Roux discovered that it was possible to neutralize the effects of an inoculation with spirochetæ by rubbing calomel ointment into the spot and so prevent the development of syphilis.

The experiment was afterward tried upon a man in the person of a medical student who offered himself for experimental purposes.

One hour after artificial inoculation upon the penis the abrasion was rubbed with calomel ointment for five minutes and syphilis did not develop.

The formula which the experimenters found to be the best is as follows:

| | | |
|---|---|---|
| ℞ | Calomel | gr. xxxiij |
| | Vaselin, anhydrous | gr. x |
| | Lanolin | gr. lxvij |

Sig.: Rub in for five minutes.

In order to be effective the ointment must be used within eighteen hours after exposure.

Two other successful cases were reported in which men had coitus with syphilitic women, used the ointment, and prevented syphilis subsequently. Other experimenters, among them Neisser, made similar tests, but were unsuccessful in preventing the subsequent development of syphilis.

The method, however, has come into very general use in the United States Army and Navy and some of the European armies, and it has resulted in materially reducing the number of syphilitic infections among the troops where it is employed.

A general knowledge and use of such a simple remedy should play an important part in reducing the spread of syphilis among the population.

## ABORTION OF SYPHILIS AFTER INFECTION

The **early excision of the chancre,** before the appearance of the secondary symptoms, was widely recommended and practiced a few years ago under the mistaken idea that the virus was strictly localized to the chancre and the tissues in its immediate vicinity, and that the poison might be entirely removed from the body by excising the sore.

Wolff, in Strasburg, excised the chancre in 500 cases, and in only 3 of them secondary symptoms did not appear.

In the 3 cases which did not develop syphilitic manifestations, the correctness of the diagnosis is always open to question, and at the present time the procedure of excising the chancre is regarded as useless in aborting syphilis.

The question has still further been studied by Neisser, who made experimental inoculations with the virus of syphilis on monkeys. He found that if the scarified area was extirpated eight hours after the inoculation it only prevented the development of the primary lesion, since in this short space of time the spirochetæ have invaded the surrounding tissues, and that previous to the development of the chancre the bone marrow and spleen contained the organisms and the virus was inoculable into monkeys.

Although it has been found, both by animal experimentation and practical demonstration on human beings, that by excision of the chancre alone it is not possible to abort the syphilis, for the reason that the spirochetæ have already made their way into the lymphatics and the blood, consequently it is necessary not only to excise the primary sore, but to institute a general antisyphilitic treatment besides. The best drug to use for the early treatment is salvarsan. Mercury is less useful because it is not sufficiently effective in destroying the spirochetæ and the secondary lesions are only retarded in their development by the use of mercury.

The early treatment with salvarsan followed by mercury and, when possible, the excision of the sore is unquestionably a great advance, and sometimes is successful in aborting the syphilis.

If from four to six intravenous injections of salvarsan are given as soon as microscopic examination of the secretion from the chancre shows the presence of spirochetæ, and are followed by an active course of mercurial treatment, preferably by calomel injections, in a goodly number of cases the syphilis has been cut short in the primary stage, as shown by an entire absence of secondary symptoms after months of observation and a permanent negative Wassermann reaction. This fortunate result may only be attained occasionally, but it is always worth trying, as no harm to the patient results from the procedure, if unsuccessful.

The chancre should also be excised when it is located in a situation where such a course is practicable.

## BIBLIOGRAPHY

Finger: Die Geschlechtskrankheiten. 1913.
Fordyce, J. A.: Am. Jour. Med. Sc., June, 1915.
Lesser: Haut und Geschlechtskrankheiten. 1904.
McIntosh and Fildes: Syphilis. 1911.
Power and Murphy: System of Syphilis. 1914.

# CHAPTER XLV

## SECONDARY SYPHILIS

### Prodromal Symptoms, or Prodromata

The spirochetæ and their toxins have the power, after they have increased in the body to a considerable amount, of destroying the red corpuscles, and on microscopic examination we find that the red corpuscles are diminished in number, with a decrease of hemoglobin, and that the number of leucocytes is increased. In consequence of these changes the skin and mucous membranes appear *pale* and *anemic.*

**Fever** is present in nearly every case. It is usually slight in well-nourished and strong individuals, but in debilitated subjects may reach 103° or 104° F.

The fever is transitory in character and usually subsides with the appearance of the eruption.

This rise of temperature occurring about the time of the eruption must not be confounded with a long-continued fever in the later stages of the disease.

Chronic syphilitic fever is described by Janeway as follows: "Syphilis in its tertiary period may occasion a fever of long duration, malaise, emaciation, and perhaps perspiration, without of necessity presenting such definite local manifestations as can be made out on such casual examination as often occurs when a patient seeks advice at the office of a consultant on one or a few occasions."

Barker believes that many of these cases of continued fever in late syphilis may be due to hepatitis.

**Nocturnal Pains.**—The shafts of the long bones, such as the tibia and ribs and the vertex of the cranium are usually affected with pains which are more or less severe, and which have the peculiarity of *remitting through the day and coming on at night, and reach their maximum intensity about midnight.*

The pains are boring or tearing in character, and are called osteoscopic pains (bone-tearing).

The headache and neuralgia are due to a congestion and swelling of the periosteum lining the narrow canals of the bones through which nerves pass and the pain is caused by pressure.

**Jaundice** occurs in a small proportion of cases, and, while its cause is not definitely ascertained, it is assumed to be due to *either* (*a*) pressure upon the common bile duct, from the enlarged lymphatic glands lying in the abdomen, or (*b*) from congestion and swelling of the mucous membrane lining the common bile duct, as a result of the disturbed circulation.

**Albuminuria** occurs occasionally. It is temporary in character and is due to congestion of the kidneys, and must not be confounded with the albuminuria which is sometimes an effect of the administration of mercury.

**Erythema of the fauces** is a most constant symptom, and appears as a generally diffused erythematous redness upon the pillars of the fauces and the pharynx.

The **spleen** is usually more or less enlarged, as occurs in all other infectious diseases.

All the symptoms described above under the term *prodromata* appear before the eruption and mucous patches, and all are occasioned by a disturbance in the local blood supply, caused by the presence of spirochetæ in the tissues, which induces a condition of hyperemia or active congestion in the various organs affected.

## SECONDARY LESIONS

**The mucous patch** is one of the most constant and characteristic lesions of secondary syphilis. It makes its appearance about the same time that the eruption is observed. In the earliest stage the mucous patch appears as a pearly white round spot upon the mucous membrane of the mouth, entrance to the vagina, margin of the anus, or under the female breast. Its development may occur wherever the skin is thin and delicate and kept macerated by secretions.

As it is seen first, the mucous patch looks as though nitrate of silver had been brushed over the surface. After a little time, the infiltrated pellicle of the mucous membrane sloughs off, leaving a shallow, sharply defined, "punched-out" looking ulcer. This might be regarded as the second stage of the process, and is the form in which the mucous patch is most commonly seen.

**The condyloma** may be looked upon as the third stage in the development of the mucous patch, and is brought about by the active growth and proliferation upon the floor of the ulcer. The result is the formation of cauliflower-like granulations, which rise in little hillocks above the level of the surrounding healthy skin.

The secretion which is very abundantly furnished by mucous patches and condylomata is highly contagious, containing large numbers of spirochetæ, and is responsible for the transmission of most of the cases of syphilis.

An infiltration of the mucous membrane, followed by ulceration, often occurs upon the tonsils and uvula, and is known as ***specific angina.***

It occurs particularly in smokers, and is very infectious.

Another condition which affects the mouth, particularly in late syphilis, consists in an infiltration of the tongue, with a thickening and cornification of its epidermis. It is termed ***leucoplakia,*** and is predisposed to by smoking.

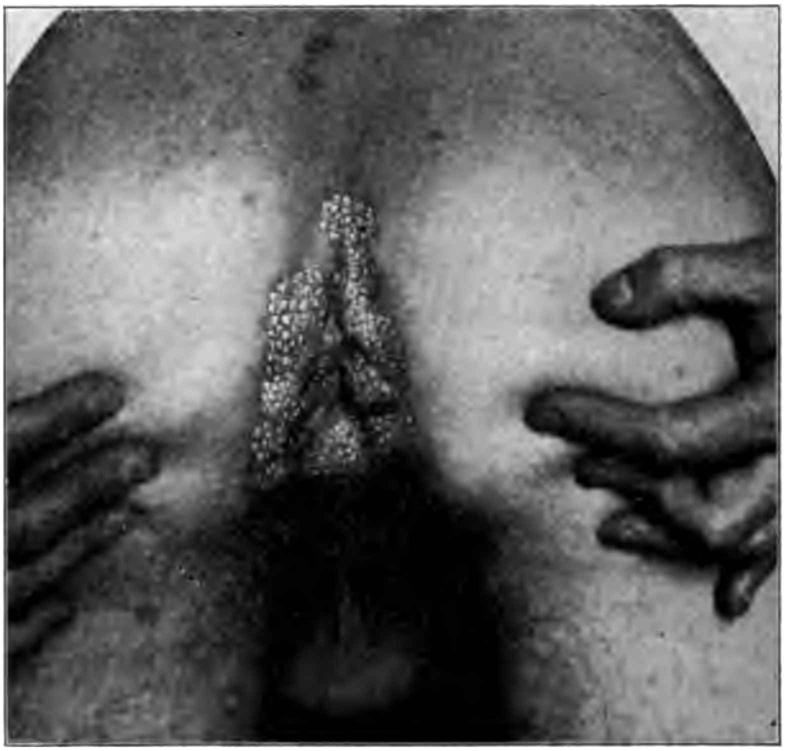

Fig. 308.—Condylomata of anus.

It is a question whether it is a syphilitic manifestation or not.

## ALOPECIA

In many cases of early secondary syphilis, although not ir ably, the hair falls out to a greater or less degree.

Alopecia occurs in various forms. It may be *complete*, in which case the hair of the head, eyebrows, and pubes may fall out entirely. The *usual* form, however, consists in a patchy baldness, the hair falling out in small patches of the size of a finger nail. In some cases there is only a general thinning of the hair, without the formation of any distinct bald patches.

The cause of the local alopecia is from trophic disturbances of the spot, caused by the former presence of a syphilitic papule.

The general alopecia is due to a general trophic disturbance of the skin and nerves from the syphilitic dyscrasia.

The *prognosis* is good, and the hair always grows in again, unless an ulcerative process has taken place upon the scalp and destroyed the hair follicles.

**The nails** are also affected by the general disturbances in nutrition. An inflammation about their roots often occurs, and furrows, running transversely across them, frequently form.

The toe nails are more often affected than the finger nails.

## SKIN ERUPTIONS, OR SYPHILIDES

All the eruptions on the skin, mucous membranes, and the pathologic alterations of the viscera, bones, and periosteum in secondary and tertiary syphilis are due to the deposit and multiplication of the spirochetæ at the diseased point.

The spirochetæ are disseminated at first by spreading along the walls of the blood and lymph channels, as is seen in the enlargement of the lymphatic glands near the chancre, and later they enter the general blood circulation, after which their spread is rapid and general, throughout the entire body.

After the first overwhelming of the body the spirochetæ disappear from the blood, and are only to be found in all the local lesions.

After the lesions have disappeared the spirochetæ still remain in the body, but so far as is known they have no particular predilection spot, although they are supposed to be seated in the glandular organs by preference.

It is also supposed that they remain in the organs which later manifest their continued presence by relapses, such as the skin, testicle, bones, periosteum, brain, and cord, which are the structures particularly liable to be attacked in recurrences.

**Microscopically** all the eruptions of syphilis are identical, and vary in outward appearance only because of the difference in the amount of cellular infiltration.

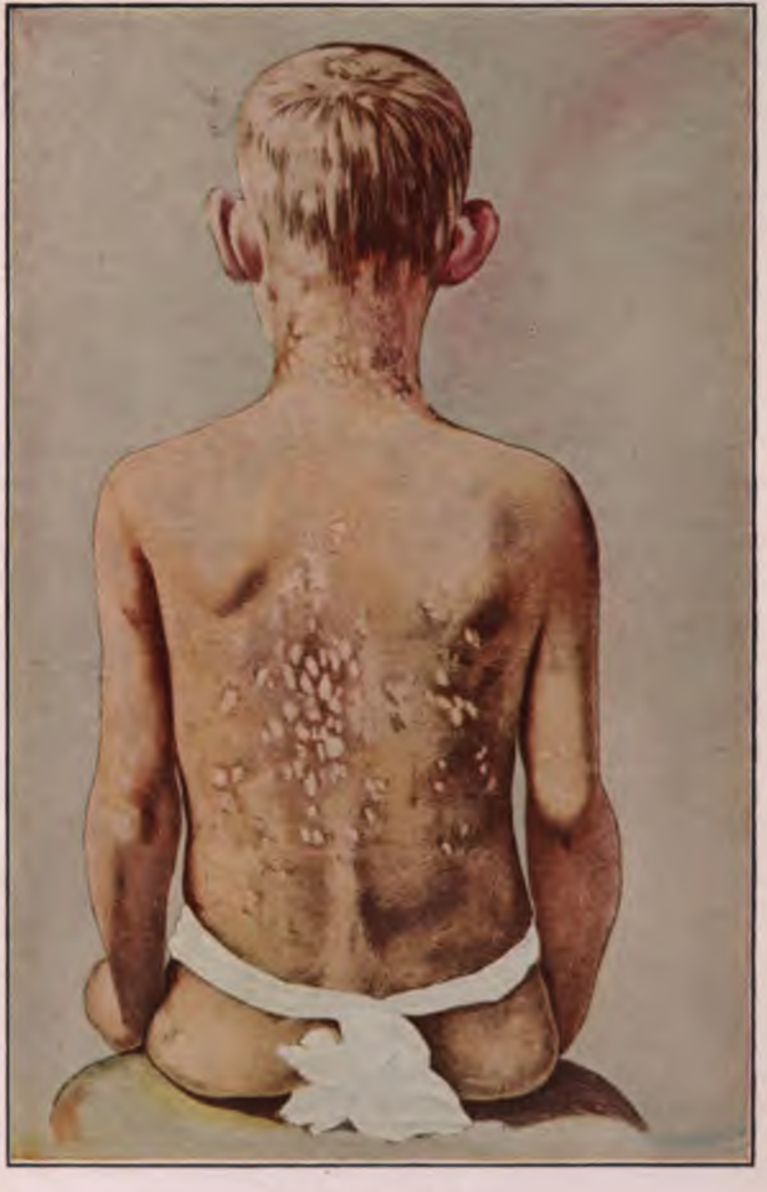

PLATE XXXII.

Pigmentary syphilide and alopecia. (Author's case, from Kings County Hospital.) Patient was a female, aged 7 years, with acquired syphilis, and presented a diffuse, widespread dark pigmentation over body and neck, with areas of white, healthy skin scattered here and there through it. The alopecia occurred in the form of patches of baldness.

Microscopic examination shows that the alterations begin in the vasa vasorum and extend to the accompanying vessels, involving the outer, inner, and middle coats.

This is accompanied by an infiltration of round cells, which are emigrated lymphocytes, and if they remain without being absorbed, become converted into spindle cells and then into connective tissue. At times the changes of arteritis and cellular infiltration are so great that the circulation of the blood through the vessels is cut off, and the parts supplied become the seat of coagulation necrosis, and slough out.

All syphilitic tissue changes are inflammatory proliferations and new formations in connective tissue, and the alterations in the primary, secondary, and tertiary stages only differ in intensity, and in the third stage by a tendency to retrogressive changes and degeneration.

The spirochetæ are found in the arterial coats to some extent, but chiefly in the vasa vasorum, thus accounting for the early hyperemic manifestations as well as the late arterial changes in tertiary syphilis.

**Classification and Anatomy of Eruptions Occurring in the Secondary Period.**—*I. Macular Syphilide.* Synonyms: Syphilitic erythema; syphilitic roseola.

The pathologic change in the skin, which is the seat of a macular syphilide, consists in periarteritis and endarteritis, with an excess of blood in the capillaries; but while the round-celled infiltration has taken place in the tissues, it is so slight in amount that it can only be detected by microscopic examination.

The spots may be large or small and are symmetrical in their location, being found upon the chest, abdomen, back, sides of the breast, and rump. The macular syphilide is very temporary in its duration, and disappears in a few days by a process of enlargement of the spots at the periphery, and their becoming pale in the center.

The **Herxheimer reaction** is a useful diagnostic measure.

It is made by injecting mercury hypodermatically and it is also noted occasionally after the use of salvarsan. After the first injection of mercury a bright-red or copper-colored zone is noted around the old macules.

The presence of this zone is characteristic of syphilis, and is *diagnostic.*

In the presence of a macular syphilide, care should be taken to distinguish it from other skin eruptions, which resemble it closely, i.e. measles, typhus, urticaria balsamica, pityriasis rosea, and tinea versicolor.

When the macular syphilide is marked in its extent, and a considerable amount of round-celled infiltration has been produced, it is readily perceptible, and forms nodules or small tumors, which are spoken of as the

*II. Papular Syphilide.*—The papules forming this variety of syphilide may be as large as a 10-cent piece or as small as a pinhead, and are accordingly classified as the *large* or *small papular syphilide.*

In certain cases the epidermis covering the papule scales off, but remains partly attached and the syphilide is then spoken of as *papulosquamous.*

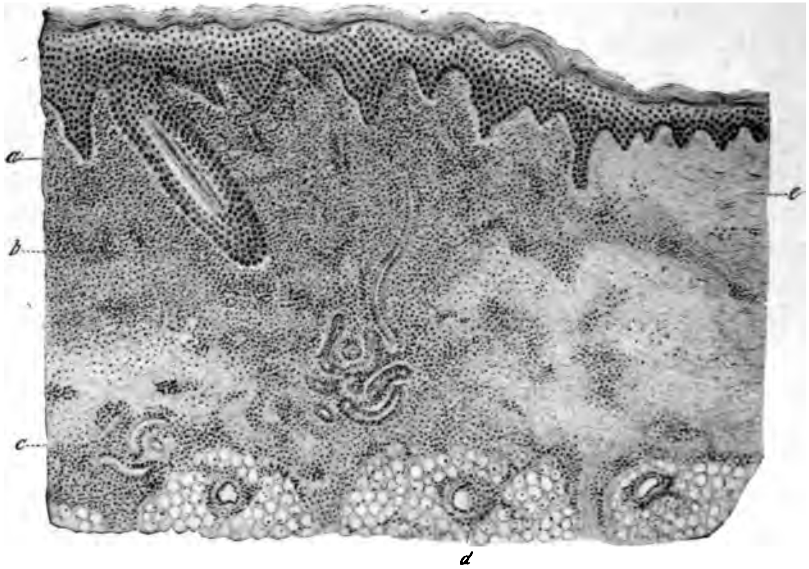

Fig. 309.—Section through a papular syphilide. *a, b, c,* small round-celled infiltration through chorium and rete muscosum and around hair follicles and sweat gland; *d,* blood vessels, with infiltration of the adventitia; *e,* normal cutis. (From "Die Syphilis und die Venerischen Krankheiten," by Dr. Ernest Finger.)

If the center of the papule becomes necrotic and breaks down, a funnel-shaped depression is formed, which is filled with pus and covered over by a scale of epidermal covering. This variety is known as the *papulopustular syphilide.*

The papular syphilide disappears by absorption, but generally leaves pigmented spots at the former site of the papules which ultimately disappear.

The *small papular syphilide* is not symmetrical in its localization, and sometimes itches, and on healing occasionally leaves scars. Care

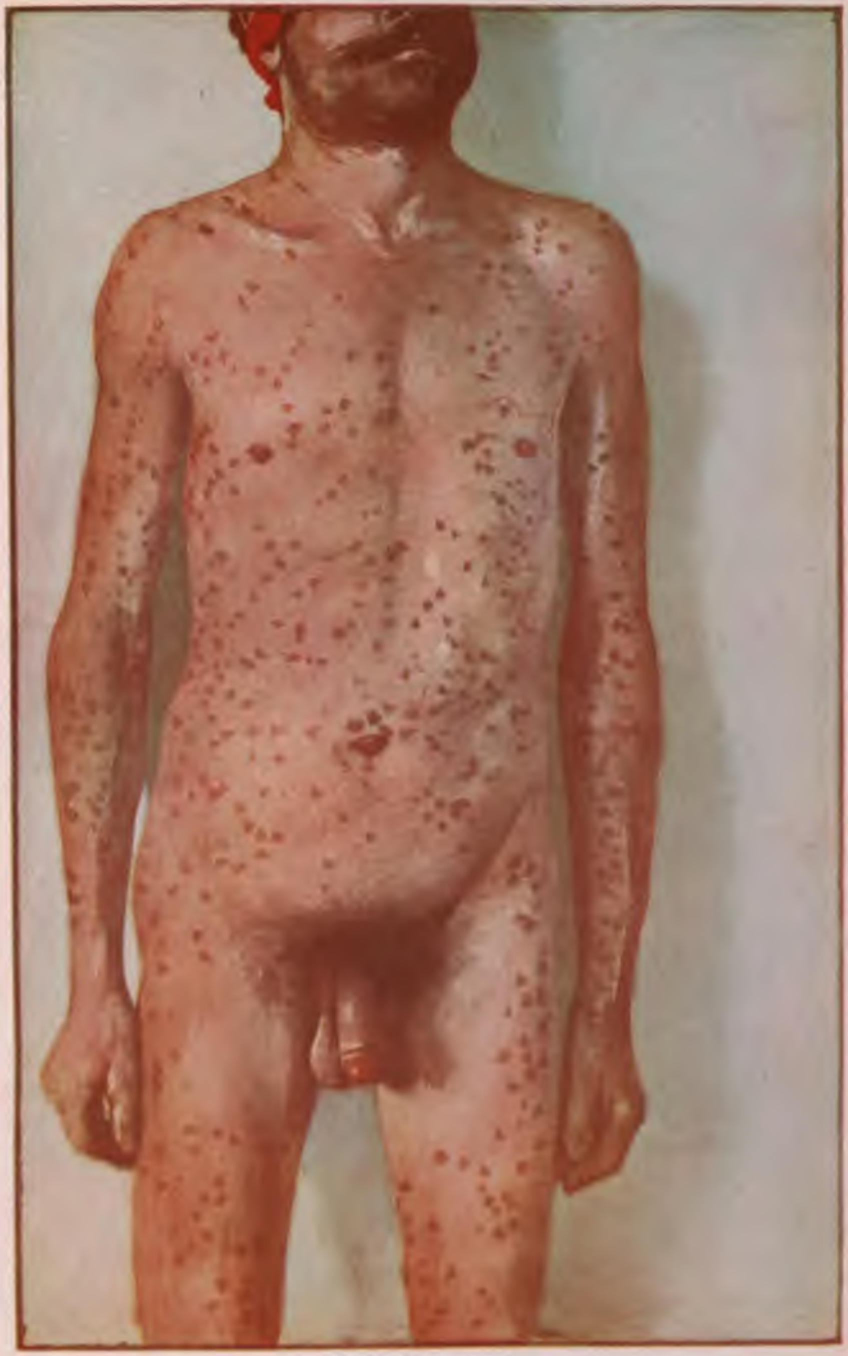

Plate XXXIII.

Maculopapular syphilida. A few papules are umbilicated and a few are beginning to scale on top. (Author's case, Long Island College Hospital.)

should be taken to differentiate it from lichen ruber planus, or lichen scrofulosorum.

The papules are sometimes grouped in circular form, localized around the mouth, nose, and genitalia. When so arranged, the lesion is termed the *circinate* or *annular syphilide,* and must be differentiated from herpes tonsurans or lichen ruber.

*III. The Pustular Syphilide.*—The pustular syphilide is formed from a preexisting papule whose central part undergoes necrosis and, as a result of obliteration of the arterioles from endarteritis and periarteritis, sloughs and breaks down. The process is then complicated by the inoculation of pyogenic microorganisms. These cause a suppuration of the central part of the papule, and the pus accumulates underneath a covering of epidermis, which is raised up above it and prevents its escape.

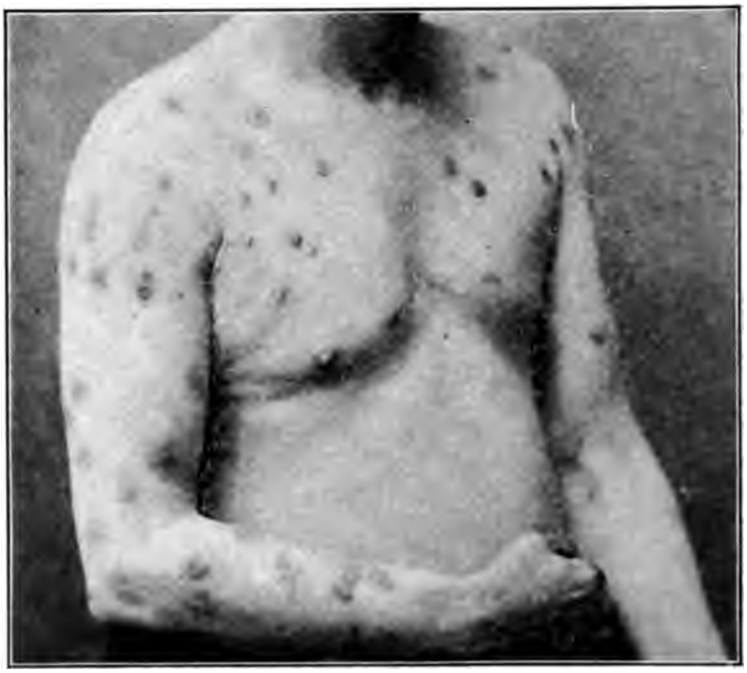

Fig. 310.—Large papular syphilide. (Courtesy of Dr. Colby.)

The pustular syphilide only occurs in debilitated or cachectic individuals, and, as it may develop with a prodromal rise of temperature, may easily be mistaken for variola.

*IV. The Pigmentary Syphilide.*—This form of syphilide, sometimes termed *leucoderma syphilitica*, should not be confounded with the pigmentation which remains after the disappearance by absorption of a papule.

The pigmentary syphilide occurs as an independent eruption upon a spot which was not previously affected. It is occasioned by the endarteritis and periarteritis, which allow the red corpuscles of the blood to escape through the vessel walls into the tissues. The hemoglobin of the escaped blood becomes dark brown in color, occasioning a pigmented appearance of the skin, and is ultimately absorbed, leaving the skin whiter in appearance than before.

The pigmentary syphilide occurs in *two forms*:

(*a*) As dark brown spots or patches of brown pigmented skin.

(*b*) As a diffuse, widespread, dark pigmentation, with areas of healthy white skin scattered here and there through it. In this form (*b*) absorption of the hemoglobin has taken place in certain areas of the pigmented patch, leaving white spots free from pigment.

The pigmentary syphilide appears on the neck and sides of the throat, and nine-tenths of all the cases occur in women. It begins in the third or fourth month of the disease, and remains in evidence from one-half to two years.

**Distribution of Syphilides over the Body.**—The portion of the skin attacked and the extent of the eruption depend upon the age of the syphilis.

The early eruptions which occur during the first six months are:

(*a*) Superficially seated in the skin.

(*b*) Generally distributed over the body, appearing first upon the chest and abdomen, spreading subsequently to the palms and soles.

(*c*) The eruption is symmetrical, occurring alike on both sides of the body, and tends to arrange itself along the course of the connective-tissue bundles which lie under the skin (called lines of cleavage).

(*d*) The early eruptions generally disappear spontaneously by absorption.

**Relapsing Syphilitic Eruptions.**—The relapses occur after the first six months, and differ in the following particulars from the early eruptions:

*Distribution.*—(*a*) While they may be distributed over the entire body, the relapsing eruptions are never so numerous as the early lesions.

(*b*) They do not follow the lines of cleavage, but are arranged in circles or segments of circles.

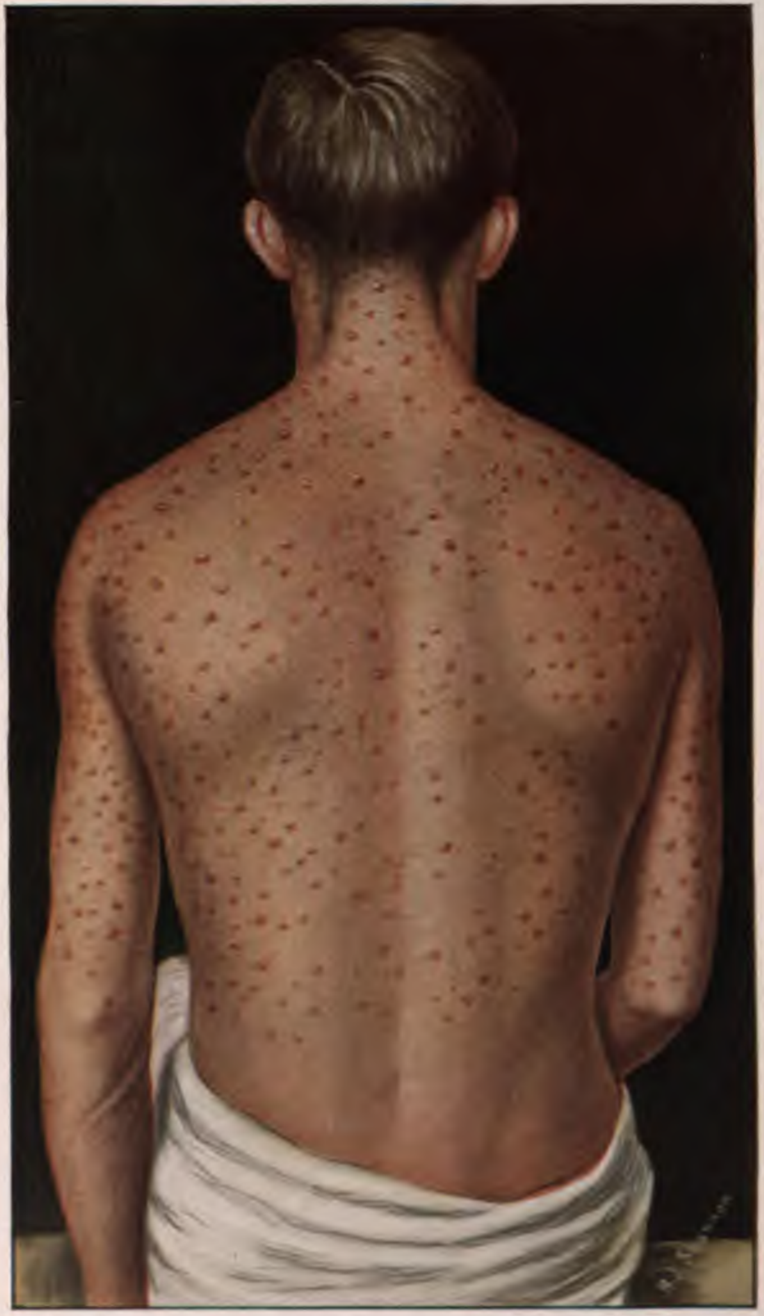

PLATE XXXIV.

Papulosquamous syphilide. (Author's case, Long Island College Hospital.)

(*c*) The groups of lesions do not tend to arrange themselves symmetrically, as a rule, but have certain *spots of predilection,* such as the genitals and anus, the mucous membrane of the mouth, the palms and soles, the upper margin of the forehead near the hair, and the flexures of the joints.

(*d*) The later eruptions are less apt to be absorbed than the early lesions, but tend rather to break down and ulcerate.

**Course of the Eruption.**—Syphilides are temporary formations which grow and spread at the periphery, or outer edge, and after reaching a certain height *absorption* or *ulceration* takes place, beginning in the center.

In this way the *ring formation occurs.* The center, or oldest part, has been absorbed and has disappeared, leaving the most recently formed portion of eruption still present as a ring around the healed center.

**Retrogressive Changes of Syphilides.**—As stated above, the process of absorption always begins in the *center* of the lesion.

The *macular* syphilide disappears most readily, and, if pigmentation were formed, it is soon absorbed, leaving the skin *whiter* than normal.

In the *papule* the central part is absorbed, leaving a depression, which is filled with epidermal scales.

The pustule is formed from a papule, and has a crater-like depression in its center filled with pus; this dries up and forms a crust, and the surrounding ring of infiltration is removed by absorption.

The papule and pustule leave traces of their presence, as spots of pigmentation, which remain on the site of the original lesion for a long time.

If the pustule has caused much necrosis of the normal cutaneous elements, a cicatrix will be formed.

**Symptoms of Syphilides.**—I. Arrangement of the lesions. II. Polymorphism. III. Color. IV. Absence of burning and itching.

*I. The arrangement* has already been considered, and depends entirely on whether the syphilide is early or one of the late relapsing eruptions.

*II. Polymorphism* is the most valuable diagnostic sign of a syphilide, and pertains to both the early and late varieties of eruption. Polymorphism may be defined as *diverse as to form,* and is brought about in the following way: The eruption in syphilis never comes out all at once, but makes its appearance in successive crops. When the eruption is viewed, if it has lasted for some little time, it may be noticed that the *older* spots have undergone transformation, while in the *later* spots the changes are less marked. Hence we find present at the same time macules, papules, and pustules, and the lesions are all of different ages and various stages of development or retrogression.

*III. Color.* The color of syphilides is frequently compared to that of an old copper cent or of lean raw ham. The color is by no means pathognomonic, as it occurs in most inflammations of the skin which are chronic. It is occasioned by arteritis, which weakens the vessel walls and allows the red corpuscles to pass out into the surrounding tissues. The hemoglobin loses its bright-red color and becomes brown.

*IV. The absence of burning and itching* is not invariable, but is usual, and is accounted for by the slow, chronic character of the development of the lesions.

**Duration of Secondary Stage.**—The secondary stage lasts a variable length of time, which may be from six to eighteen months, and may be set down as about one year, on the average.

In cases which follow a favorable course, *relapses* cease to occur and the disease appears to be at an end.

It is not possible to draw any distinct line of demarcation between the secondary and tertiary periods, for as the lesions continue to recur they gradually lose the distinguishing characteristics of secondary syphilis and become distinctly tertiary.

In the secondary stage the visible manifestations of the disease occur chiefly upon the skin and mucous membranes, and, while the viscera, eyes, and nervous system are occasionally attacked, they are not apt to be affected.

In the tertiary stage, however, the affections of the skin are trivial in comparison with the damage which may be wrought in other vital organs.

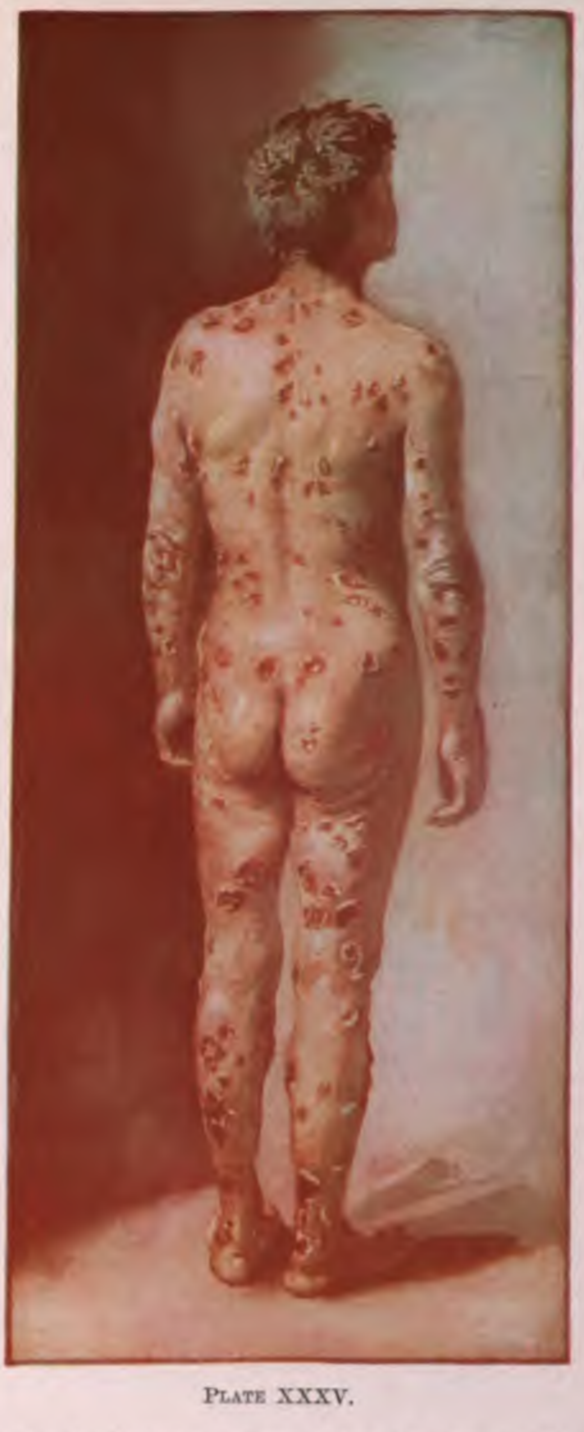

PLATE XXXV.

Relapsing eruption in late secondary syphilis, showing general distribution, asymmetry of arrangement, and ring form of lesions. (Author's case, Long Island College Hospital.)

# CHAPTER XLVI

## TERTIARY STAGE OF SYPHILIS

It was formerly supposed that tertiary syphilis was not due to a living poison, but was more in the nature of a diathesis. Since the discovery and study of the spirochetæ it is known today that these organisms are still present in the body in the tertiary stage, although fewer in numbers than in the secondary stage, and not so generally disseminated, and that all the local lesions of the tertiary period are caused by the presence and irritation induced by the spirochetæ in the structures which become the seat of pathologic alterations.

It was also the belief that the tertiary lesions were not contagious, and that is in practice actually the case, for the reason that the secretions from tertiary lesions contain only pus without spirochetæ.

The spirochetæ exist only in the hard edges of the tertiary lesions, and do not make their way into the discharge which flows from the open wound.

Animal experimentation, however, has shown that it is possible to transmit syphilis in the third stage by artificial inoculation, for Finger, Landsteiner, Neisser, and others have successfully inoculated monkeys with syphilis from tertiary lesions.

In one of Finger's cases the gummatous tissues were obtained from a man who had contracted syphilis some twelve years previously, and the conclusion must be drawn that so long as spirochetæ are present, tertiary lesions, whether ulcerated or nonulcerated, are contagious.

Individuals who are strong and well-nourished and who are systematically and carefully treated for a sufficient length of time rarely develop tertiary symptoms.

Marschalko, in a study of 673 cases, states that as a result of good treatment, tertiary lesions occurred in only 2.7 per cent; in imperfectly treated cases they occurred in 19.3 per cent, and under insufficient treatment they developed in 23.9 per cent.

It is evident from these figures that tertiarism is almost wholly due to insufficient treatment or ignorant management.

Tertiary lesions do not occur before the second year (except in malignant syphilis), and when they do occur they appear in most cases from three to four years after infection, and from this time they occur progressively less in frequency, until about the tenth or twelfth year.

From the twelfth to the twentieth year their appearance is only exceptional, and after twenty years, extremely rare.

The lesions of tertiary syphilis occur first in point of frequency in the skin, next in the nervous system, the bones, mucous membranes, and viscera.

The great danger to the life or usefulness of the individual lies in the occurrence of the lesions of tertiary syphilis in the nervous system, attacking either the brain or spinal cord, and it is in order to prevent these accidents that the treatment should be most actively carried out, especially in the early secondary period of the disease.

A notable difference between the secondary and tertiary periods is, that while in secondary syphilis the lesions run a definite and regular course in their development and retrogression, with periods of latency between the eruptions, and are symmetrically diffused over the body, generally superficial, and have a tendency to spontaneous healing, the tertiary lesions act in a directly opposite manner in all these particulars, as will be seen by the accompanying table:

**Characteristics of Lesions of Skin and Mucous Membrane.**—The characteristics of the syphilides in the tertiary period differ greatly from the secondaries, and may be summarized as follows:

I. They attack a limited area.

II. They have a tendency to extend and cause destruction of tissue, with the formation of scar tissue and its subsequent contraction.

III. They do not tend to spontaneous recovery, but rather break down and ulcerate.

IV. They extend deeply into the tissues.

Tertiary lesions, in whatever organ or structure of the body they may occur, are the direct result of chronic vascular lesions, and are commonly accompanied by the so-called gumma.

## Pathology

**Arterial Changes.**—In the tertiary period of syphilis, **arteritis** plays an important role. In the *secondary period* the inflammatory changes in the vessels are more apt to involve the *adventitia,* but in tertiary syphilis the *inner* coat is more likely to be attacked.

The presence of spirochetæ in the vasa vasorum and arterial coats causes a chronic inflammation of the vessel walls with an infiltration of small round cells between the *intima* and the *endothelial lining* of the artery, and this infiltration ultimately becomes organized into connective tissue. The contraction of the tissue thus formed causes a narrowing of the caliber of the artery, and, indeed, it may lead to the total closure of its lumen, and the vessel becomes transformed into a solid string of connective tissue (endarteritis obliterans).

When the arterial wall is the seat of an inflammatory process which is very *circumscribed,* instead of its lumen becoming narrowed or obliterated, its walls may be stretched and dilated, and in this way small *miliary aneurisms* are formed.

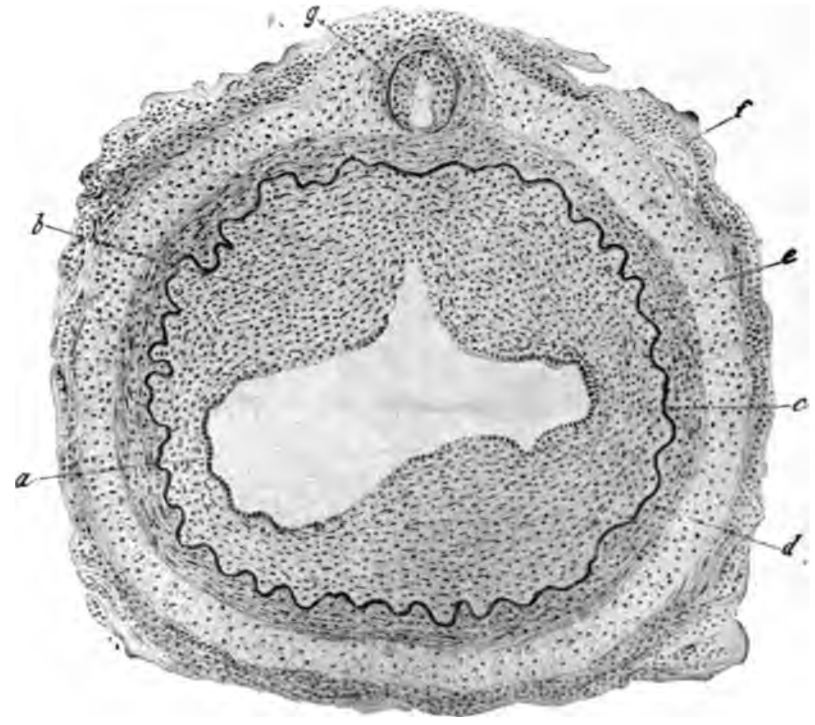

Fig. 311.—-Endarteritis (artery from the fissure of Sylvius). *a,* swollen and infiltrated endothelial lining; *b,* new formation composed of connective tissue and small round-celled infiltrations; *c,* membrana elastica; *d,* muscular coat; *e,* media; *f,* adventitia (all above layers infiltrated with small round cells); *g,* nutrient artery (vasa vasorum). From "Die Syphilis und die Venerischen Krankheiten," by Dr. Ernest Finger.)

The process is not uncommon in the aorta, and the spirochetæ have been discovered in aneurism of the aorta.

*Gummous arteritis* is a rare affection, consisting in the formation of small gummata, which grow from the media and push upward, covered by the unchanged intima, into the lumen of the artery. The center of the gumma generally becomes cheesy and breaks down.

Obliterating endarteritis can also exist at the same point in the vessel, in addition to the gumma.

**Gumma**[1] is always preceded by and dependent upon the arteritis. It occurs especially in the skin, periosteum, meninges of the brain and cord, and the abdominal viscera, particularly the liver, spleen, and testicle.

The gumma consists of a circumscribed mass of new tissues varying in size from a pinhead to a hen's egg, and is composed of a hyaline matrix, in which are imbedded small round cells, and occasionally giant cells. Small gummata may disappear by absorption, but in gummata of larger size the nutrition of the central parts of the tumor is cut off, by the pressure of the hyperplastic tissue on the blood vessels, and by the accompanying endarteritis, and the center of the tumor undergoes coagulation necrosis.

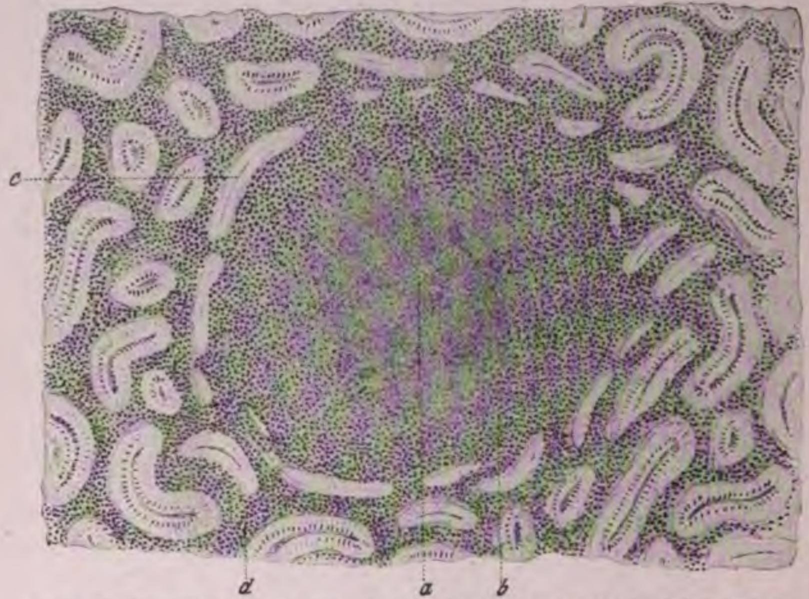

Fig. 312.—Gumma of the testicle. *a*, central portion seat of coagulation necrosis; *b*, peripheral zone formed by infiltration of small round cells; *c*, compressed tubuli seminiferi; *d*, interstitial small round-celled infiltration.

As Schaudinn observed, the spirochetæ are found in the periphery of the necrotic areas, which accounts for the relative noninfectivity of the tertiary lesions.

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[1] The name of infectious granulomata was given by Virchow to a class of diseases whose development does not pass beyond the stage of *formation of granulation tissue*, which is transitory in the character of its duration and ends by ulceration. In addition, it is nearly allied in its formation to the process of inflammation. The class of infectious granulomata includes syphilis, tuberculosis, leprosy, actinomycosis, mycosis fungoides, rhinoscleroma, and glanders.

In the very early stage of the gumma the spirochetæ exist in the walls of the blood vessels and the surrounding cellular infiltration, but when the artery becomes obliterated and degeneration occurs the spirochetæ disappear.

In this way the peripheral distribution of the spirochetæ is explained.

After a gumma has lasted for some time, it is found to be composed of an old central part, made up of fatty, cheesy, broken-down cells, and an outer zone which has been transformed into a fibrous connective-tissue envelope, surrounding the softened sloughing center.

A gumma may exist singly, or there may be several present, lying close together. The circumscribed form of gumma developing in the skin is termed a *syphilitic tubercle.*

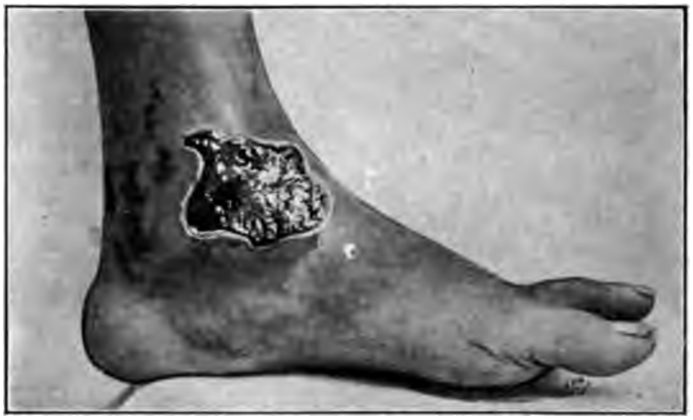

Fig. 313.—Ulcerating gumma of the ankle. (Author's case, Kings County Hospital.)

## Classification of Skin Eruptions

The eruptions which occur upon the skin in tertiary syphilis are all occasioned by the formation of gummata in the skin or subcutaneous connective tissue and their subsequent progress of ulceration, and are classified as follows:

I. Gumma: (*a*) Of the skin. (*b*) Subcutaneous tissue.
II. Tubercular syphilide: (*a*) Dry or atrophic. (*b*) Ulcerative.
III. Rupial syphilide.

(*a*) **Gumma of the Skin.** (*b*) **Gumma of the Subcutaneous Tissues.**—Gumma of the subcutaneous tissues is the cause of the deep

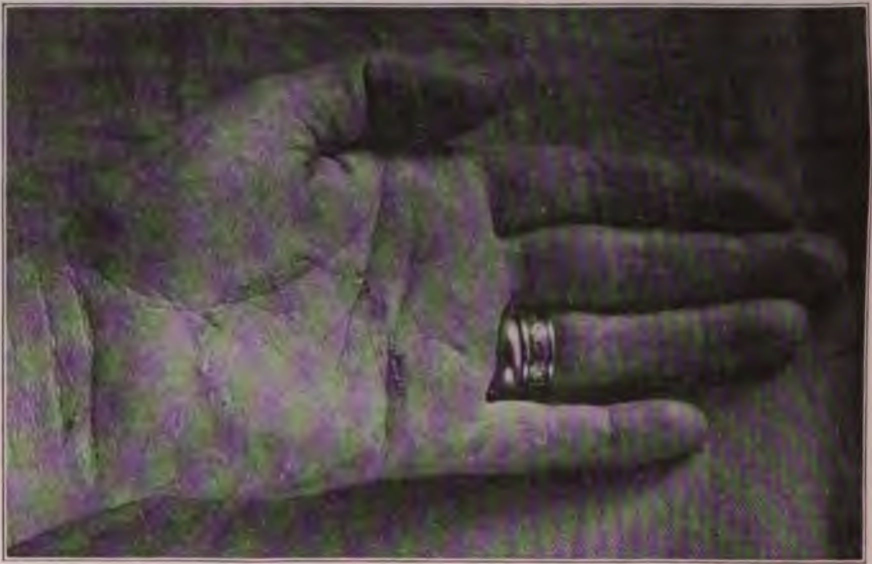

Fig. 314.—Circinate squamous syphilide. (Fox, Howard: Palmar Syphilides. Am. Jour. Syphilis, 1917, i, No. 2.)

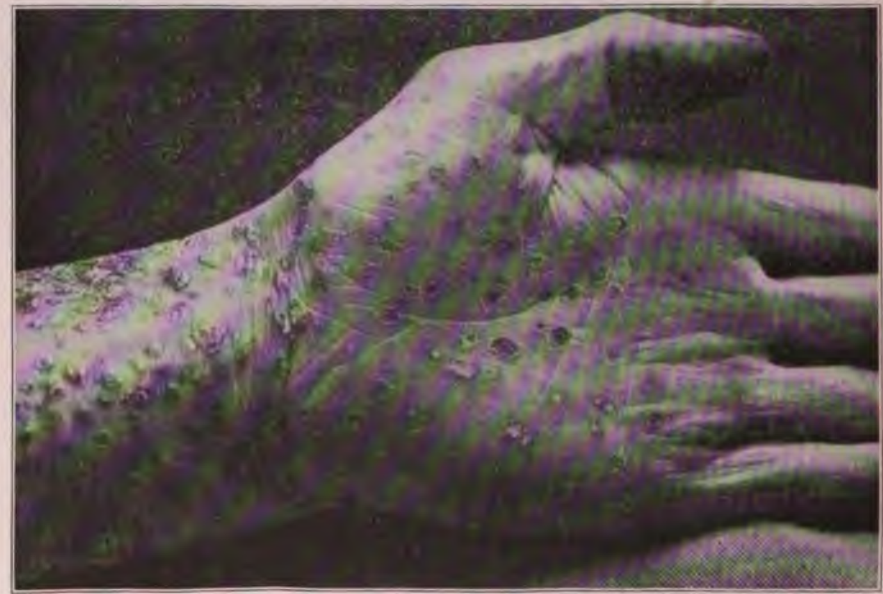

Fig. 315.—Papular syphilide, with marked scaling. (Fox, Howard: Palmar Syphilides, Am. Jour. Syphilis, 1917, i, No. 2.)

ulcerations commonly met with in tertiary syphilis. The skin lying above the gumma becomes attached to it by the inflammation, softens, and sloughs away, exposing to the air the cavity which was formed in the central part of the gumma by the coagulation necrosis of the new infiltrating cells. As the ulcers heal, a cicatrix is formed which dips down into the cavity of the gumma, and a depressed scar, attached firmly to the subcutaneous tissues, remains at that point.

The circumscribed form of gumma which develops in the skin is termed a syphilitic tubercle. This condition is entirely distinct from tuberculosis of the skin, which depends upon the tubercle bacillus, and in this instance the word tubercle means a little tuber, or small nodule. The tubercular syphilide appears in two forms:

(*a*) **Dry, or atrophic, tubercular syphilide,** which is so called from the fact that it does not break down and undergo destruction, but tends to dry up and disappear by absorption.

It is this variety of syphilis which occasions the ringed form of eruption which comes on late in the course of the disease. (See plate.)

The atrophic tubercular syphilide often affects the palms of both hands in the secondary stage, or one hand in the tertiary, and is easily mistaken for palmar eczema.

When occurring about the face or on the body, the eruptions may be taken for psoriasis or lupus erythematosus.

(*b*) **The ulcerative form of tubercular syphilide** takes its name from the fact that, unlike the atrophic form, it is not absorbed, but breaks down and ulcerates, continually spreading farther at the edge and healing in the center. From this tendency to extend at the periphery and involve fresh areas of tissue it is sometimes termed the *serpiginous syphilide.*

This eruption must be differentiated from lupus or epithelioma, and in doubtful cases it may be necessary to put the patient on antisyphilitic medication in order to decide the question.

**The rupial syphilide** derives its name from the concentric rings of crusts which form the scab, resembling the rings of an oyster shell. The formation of the rings occurs in this manner: A small gumma forms in the skin, ulcerates, and the ulcer is covered with a crust. The ulceration extends at the periphery; a ring of crust is formed over the new ulceration and lies underneath the first crust and, as it is larger in size, projects all around it. As the ulceration extends, other layers of crust are formed underneath the original ones, and each additional crust which forms is larger in diameter than the one preceding it and is not entirely covered, so that the edge is seen forming a ring around the crust above it.

The lesions above described are all deeply seated, involve the subcutaneous tissues, and result in more or less destruction of tissue, which is healed by the formation of contracting cicatrices.

## MALIGNANT SYPHILIS

Syphilis is said to be malignant when it pursues a rapid, destructive, and uncontrollable course from the outset, and it often occurs in individuals who are debilitated by tuberculosis, alcoholism, or bad nutrition and privation; but it may also occur in strong, well-nourished persons. Why syphilis should at times pursue a rapid and uncontrollable course, and at others be very mild and amenable to treatment, is not clearly understood.

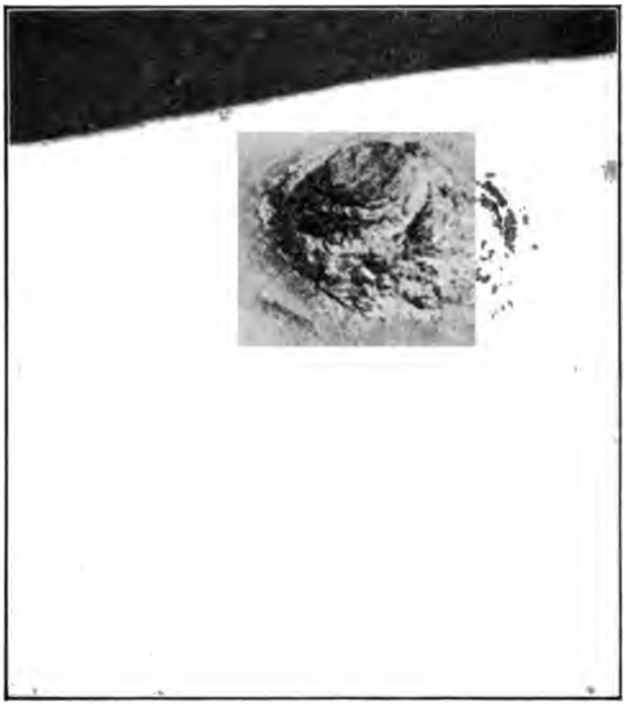

Fig. 316.—Rupial syphilide. (Author's case, Polhemus Clinic.)

One theory is that a certain immunity to the disease has been acquired through heredity, which affords a partial protection, for it has been noted that when syphilis is first introduced among a new people

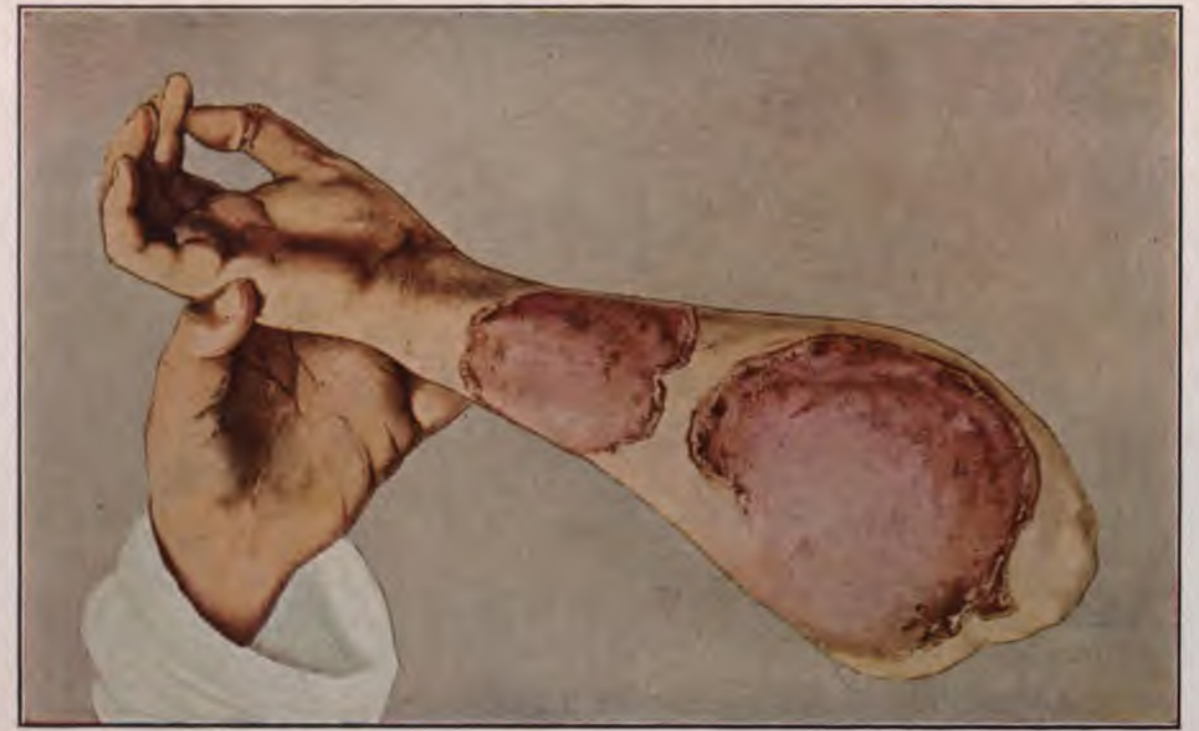

PLATE XXXVI.

Dry or atrophic tubercular syphilide. (Author's case, from Kings County Hospital.)

who are unaccustomed to it, many cases of the malignant type occur.

Another theory is that the lymphatic glands do not delay the entrance of the poison into the blood sufficiently to allow antibodies to form, and the body is overwhelmed rapidly with the poison, for it has been observed that there is but very slight swelling of the lymphatic glands in these cases.

The severity of malignant syphilis is increased from the fact that it resists ordinary treatment, for such patients do not stand the administration of mercury and iodide of potassium well.

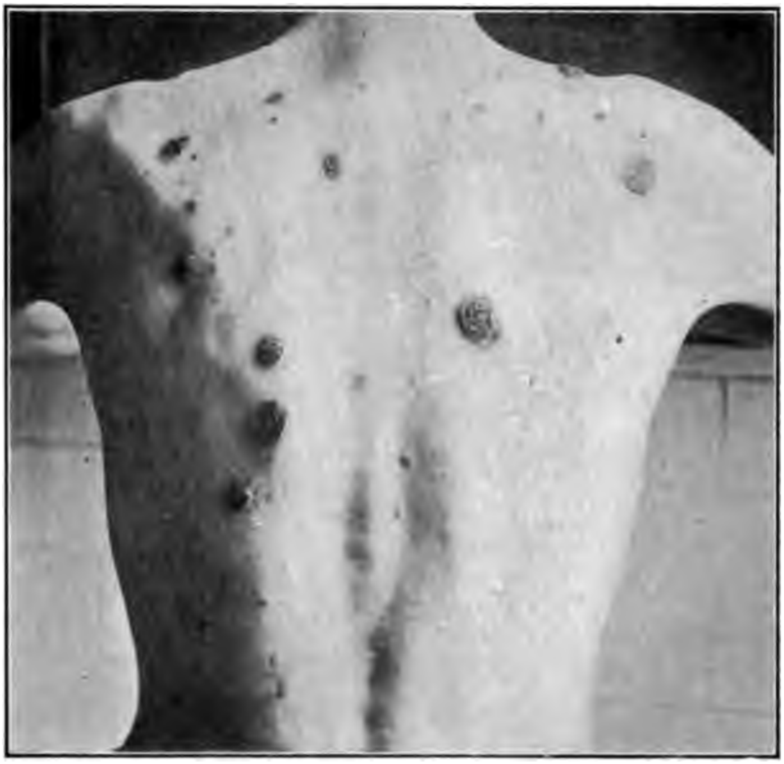

Fig. 317.—Malignant syphilis. Pustular eruption. (Author's case, Polhemus Clinic.)

Malignant syphilis usually begins with fever, and the brain often becomes the seat of a gumma or an obliterating arteritis.

The early lesions are generally distributed over the body, are pustular in character, break down, and cause extensive ulcerations. The anemia from the destruction of the red corpuscles is very

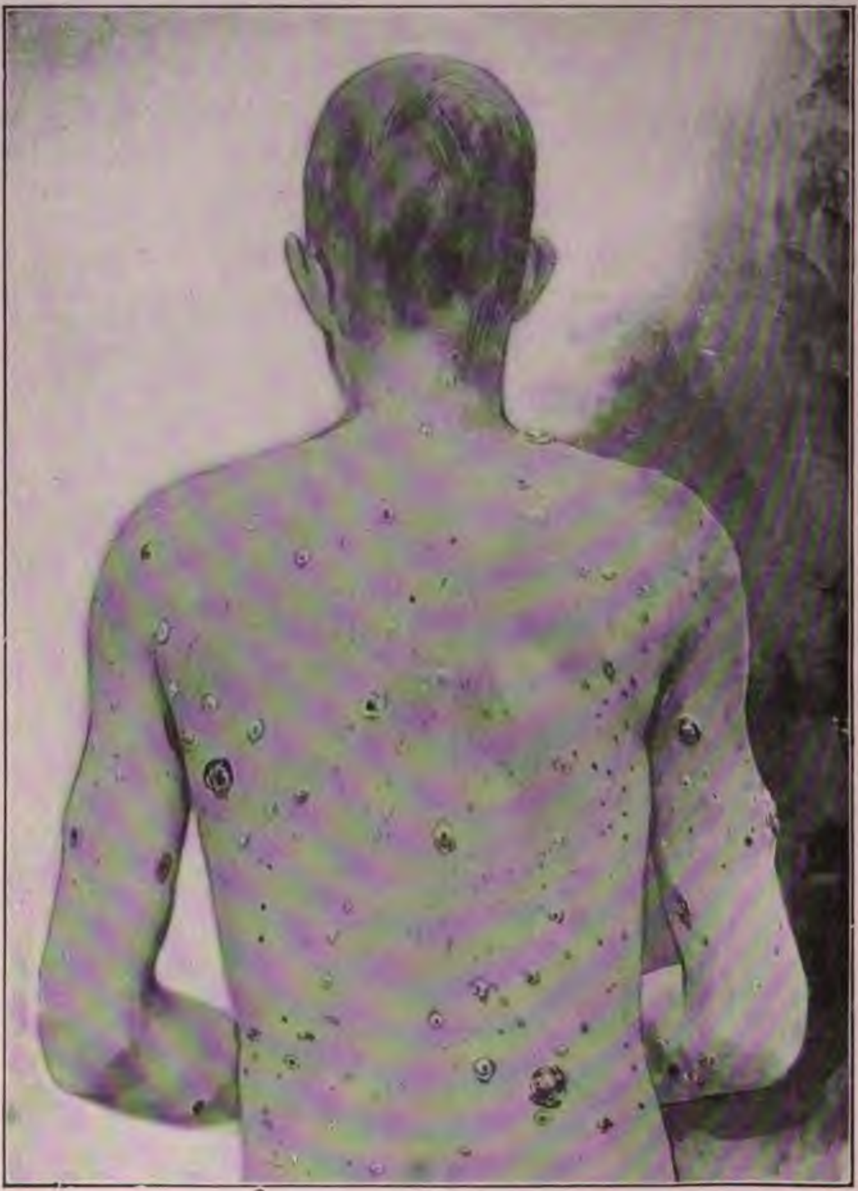

Fig. 318.—Pustular syphilide (malignant syphilis). (Author's case, Kings County Hospital.)

marked, and the cachexia is strikingly evident. The subcutaneous fat is absorbed and the patient emaciates rapidly.

Sometimes the secondary stage is entirely lacking, and gumma develops prematurely, so that four or five months, or at most a year and a half, after infection the most extensive, widespread ulcerations, diffused over the entire body, may be present.

The ulcers often begin without any appreciable preliminary stage of infiltration. Death may result from destruction of some vital organ, or the prolonged suppuration of the ulcers may cause death from amyloid or fatty degeneration of the viscera, or general marasmus.

If the resistance of the system is enough to withstand the drain for two years, the virulence of the disease is exhausted, and the patient may live, but in a weak and debilitated condition of body.

# CHAPTER XLVII

# SYPHILIS OF THE VISCERA, THE BONES, AND THE NERVOUS SYSTEM

In the foregoing section we have considered only the lesions of syphilis occurring in the skin and mucous membranes, but as has already been indicated, the changes in the tissues caused by the spirocheta are not confined to any one structure.

The pathologic processes of endarteritis and periarteritis, with their accompanying cellular infiltration of tissue and the resulting degenerative changes in the neighboring structures, as well as the gummatous infiltration occurring in the later period of syphilis, are liable to attack any organ in the body, and the symptoms resulting depend wholly upon the function of the organ attacked and it is herein that the extreme importance of syphilis as a death factor in the human race lies.

Syphilitic disease of the skin and mucous membranes, while it may cause disfigurement and impairment of function, is very rarely the cause of death, while the effects of syphilis upon the viscera are responsible for as many deaths as tuberculosis. For this reason it is of the highest importance to understand the changes in the internal organs, nervous system, and bones and joints brought about by the disease.

As Osler truly remarks—"Know syphilis and you know internal medicine" the writer has endeavored to call attention to some of the more common conditions in the following section.

## ALIMENTARY TRACT

**The Mouth.**—Attention has already been called to the occurrence of chancres upon the tongue, lips, and tonsils as the result of extragenital infections.

The buccal mucous membrane and tongue in tertiary syphilis is sometimes the seat of a thickening and cornification of the cells which appear like whitish gray plaques resembling psoriasis. This condition is known as leucoplakia and while not necessarily of a syphilitic origin, is more apt to occur in syphilitic individuals than in healthy ones.

The tongue is frequently affected in tertiary syphilis and it may be the seat of localized gummata or more commonly by a diffuse infiltration which causes it to be thickened and cracked and deeply fissured.

This condition resembles carcinoma and clinically may be easily mistaken for it, but a positive Wassermann will serve to differentiate the two conditions.

Gummatous ulceration and perforation of the hard and soft palate are frequently seen, causing difficulty in speech and the regurgitation of fluids and food from the pharynx into the nose.

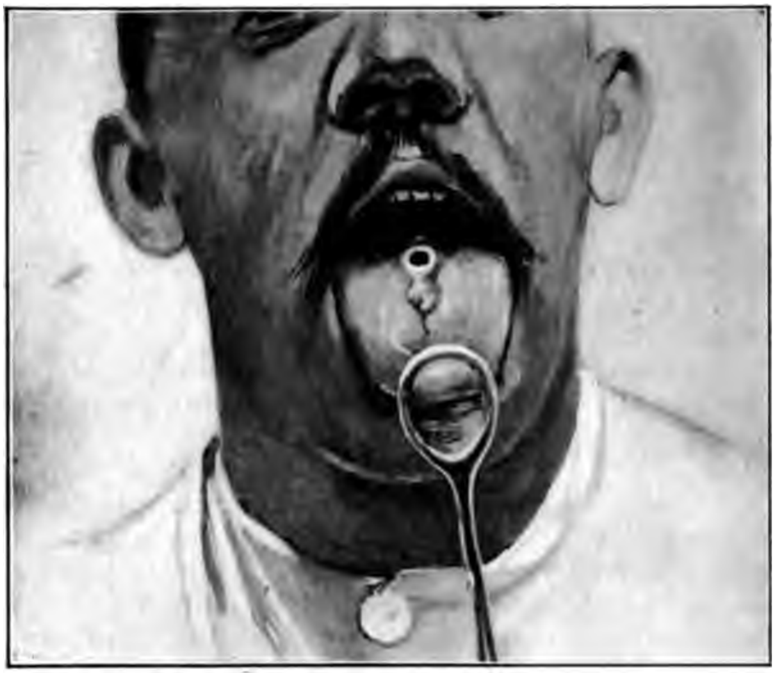

Fig. 319.—Gummata of the tongue. The one in the middle has undergone coagulation necrosis of its center. (Author's case, Kings County Hospital.)

## STOMACH

Diffuse infiltrations and gummata in the stomach have been described, which break down and cause extensive ulcers with hemorrhages and impairment of digestion, easily distinguishable from the ordinary round ulcer of the stomach.

## RECTUM

The rectum may be the seat of the gummata localized in the submucous tissues or of a diffuse and widespread ulceration of the whole wall of the gut. This soon breaks down into extensive ulcers which completely encircle the lumen and are further complicated with fistulæ which run into the adjacent tissues.

Such ulcers occasion a foul discharge and great pain on defecation.

As healing by scar formation and contraction takes place, the lumen of the gut is constricted so materially as to interfere with the passage of feces, and alternate constipation and diarrhea occur. The intestine above the stricture is dilated and ulcerated, and the patient usually dies from some intercurrent affection superimposed upon the intestinal toxemia.

## LIVER

This organ is more frequently attacked by the syphilitic process in the tertiary stage than any of the other viscera.

The usual change consists in the formation of gummata, with extensive inflammatory infiltration of the liver substance and scarring.

The gummata may be diffused, but sometimes coalesce into a large tumor-like mass pushing aside the liver tissue and causing a certain amount of destruction of the normal substance.

Another type of disease due to syphilis is the chronic interstitial hepatitis, which causes the formation of numerous coarse bands of gray fibrous tissue separating large areas of relatively healthy tissue from one another by deep sulci, causing the liver to appear as if cords had been tied tightly around it, cutting deep into its substance.

Such cases present the features of cirrhosis of the liver, with the attempts at repair and the disturbances of circulation, and ascites, portal stagnation, enlargement of the spleen, and jaundice are frequently noted in these patients.

Unless a Wassermann is made such a case could easily be mistaken for carcinoma of the liver.

Barker suggests that the continued fever sometimes observed in tertiary syphilis may be due to an interstitial hepatitis.

## SPLEEN

In secondary syphilis an enlargement of the spleen is frequently observed and in tertiary syphilis the spleen may be the seat of gummata or a chronic interstitial inflammation.

## RESPIRATORY TRACT

In rare cases of extragenital chancre the initial lesion may be located in the vestibule of the nose, on the alæ, or upon the nasal septum, and may pass unrecognized until secondary symptoms appear.

In tertiary syphilis ulceration and perforation of the nasal septum are common, and gummatous lesions form in the perichondrium or periosteum of the bones forming the interior of the nose. The septum and turbinated bones may be completely destroyed and the nose converted into one large cavity, lined with a scarred and atrophied mucous membrane, and accompanied by a disgusting fetor until the necrotic bone has been finally thrown off.

In consequence of the destruction of the septum the "saddle-nose" so characteristic of syphilis is formed. In this deformity the bridge of the nose is sunken and the tip turns upward exposing the nostrils in front.

In cases where the disease is neglected, the skin may be ulcerated and the whole nasal cavity is open to the outside and into the mouth, so that all human resemblance has disappeared.

## LARYNX

A subacute catarrh is common in secondary syphilis and hyperemia and sometimes papules and erosions may be seen with the laryngoscope. In tertiary syphilis gummatous infiltrations form in the submucosa or perichondrium.

In course of time they break down, leaving punched out ulcers with firm, reddened margins and as they cicatrize, stenosis and deformity results.

A laryngoscopic examination should always be made when a syphilitic patient complains of hoarseness or difficulty in swallowing. Laryngeal syphilis responds readily to treatment in the early stages, but if permitted to go on until ulcer has healed with a heavy cicatrix, a fatal laryngeal stenosis may result from the contraction of the scar.

## TRACHEA AND BRONCHI AND LUNGS

Gummatous infiltration in the trachea and bronchi causes thickening of the wall with ulceration which lays bare and softens or destroys the cartilage rings, causing the trachea and bronchus to collapse at an angle or be compressed. When healing takes place, a cicatrix is formed which causes a stenosis of the canal.

The region of the bifurcation of the trachea seems to be the usual seat of the lesion and one bronchus is narrowed by the stricture. causing a bronchiectasis in the lung.

A bronchostenosis may be recognized by the radiographic shadows and trachea bronchoscopy may disclose the syphilitic nature of the lesion.

In the lung itself, the changes caused by syphilis are not very clear or easy to differentiate from pulmonary tuberculosis. Gummata of various sizes, even forming tumor-like masses occur anywhere in the lung. They are sharply outlined, and fibrous strands are seen radiating from them into the rest of the lung.

Lewellys F. Barker states that in differentiating pulmonary syphilis from pulmonary tuberculosis certain important facts should be formed in mind.

"1. In syphilis it is the root of the lung and the central areas that are most often involved, whereas in tuberculosis an apical process is most common.

2. In syphilis, cavity formation, except bronchiectatic, is rare even in advanced stages.

3. Bronchostenosis is common in syphilis, rare in tuberculosis."

The commonest symptoms of pulmonary syphilis are cough, dyspnea, and hemoptysis.

The physical signs of syphilis of the lungs are rarely characteristic enough to give a clue to the etiologic diagnosis.

When the signs suggest a chronic inflammatory process in the lung and repeated examinations of the sputum are negative for tubercle bacilli, the Wassermann test should be applied.

The history, together with careful examination of other parts of the body for luetic lesions, and good radiograms, may be of help in the differentiation.

Mycosis of the lungs and neoplasms may sometimes be confused with syphilis of the lung.

## HEART AND BLOOD VESSELS

In tertiary syphilis distinct gummata may occur anywhere in the heart muscle, but have a tendency to be located in and about the conducting bundle of His and especially at the point in the septum behind the tricuspid and below the aortic valves where it is most concentrated. On account of their site the conduction system is often interrupted causing *heart block.*

## ARTERIES

Attention has already been called to the changes occurring in the arteries in secondary and tertiary syphilis. These are very constant and definite in character and give rise to varied clinical pictures depending on the function of the parts supplied by the diseased blood vessels.

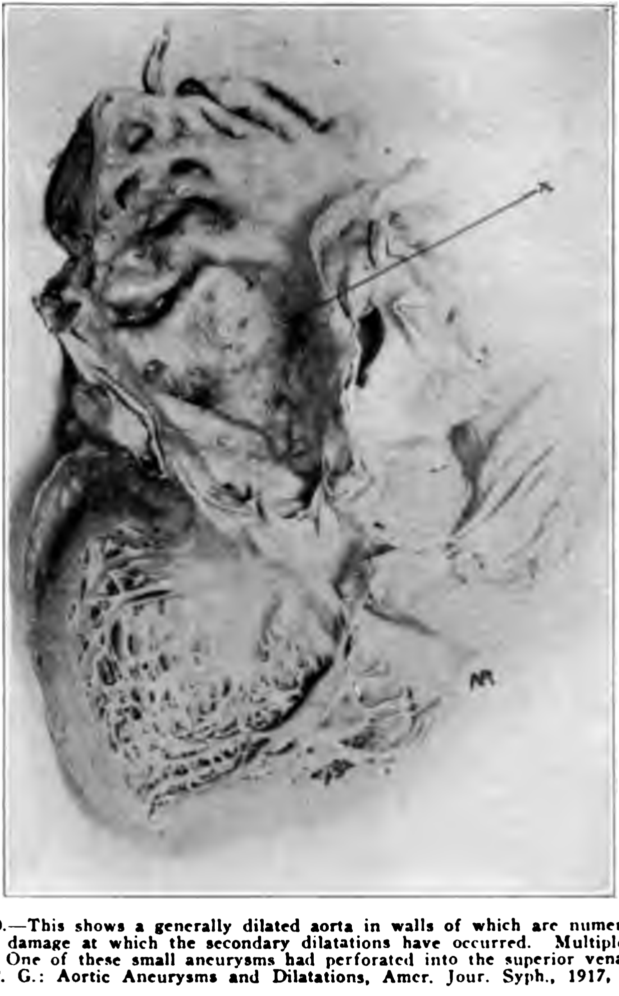

Fig. 320.—This shows a generally dilated aorta in walls of which are numerous foci of more severe damage at which the secondary dilatations have occurred. Multiple secondary aneurysms. One of these small aneurysms had perforated into the superior vena cava (X.) (Woolley, P. G.: Aortic Aneurysms and Dilatations, Amer. Jour. Syph., 1917, i, No. 3.)

The aorta is affected as well as the smaller vessels and aortitis is apparently the commonest cause of insufficiency of the aortic valves as well as aneurysm formation.

Syphilitic disease of the aorta has been carefully studied, the spirochetæ have been found in its lesions and even produced syphilis in other animals when artificially inoculated.

The inflammatory changes affect all three coats of the aorta and the vasa vasorum as well. The changes usually begin at the aortic orifice, where they involve the aortic valves and extending along the arch downward into the descending aorta where they stop abruptly just above the orifices of the abdominal vessels. The aortic valves are thickened and shortened so that they become insufficient and the aortic ring is widened, increasing the incompetence of the valves. The wall of the aorta is thinned and aneurysmal dilatations of various sizes accompany the later stages of the disease.

The mouths of the coronary vessels become narrowed to a small caliber, which accounts for the symptoms of angina pectoris. The openings of the intercostal vessels and even the carotids may be narrowed at their mouths.

Although the spirochetæ are deposited in the walls of the aorta early in the secondary period, it is usually about eighteen years after infection before the symptoms of aortitis are apparent and a much longer period may elapse before symptoms appear.

The symptoms of this condition are: (1) slight dyspnea, (2) precordial oppression or pain, (3) attacks of paroxysmal dyspnea or angina pectoris, and (4) attacks of unexplained weakness.

In the presence of these symptoms a Wassermann should be made and a radiogram taken of the cardiovascular stripe. If a positive Wassermann and if the radiogram shows diffuse dilatation of the aorta from its root to the diaphragm, the diagnosis can be made almost with certainty. An important practical deduction may be drawn from these studies. It is probable the positive Wassermann reaction of latent syphilis may be due to the unsuspected presence of spirochetæ in the aorta and thorough treatment of these latent cases of syphilis will prevent the deadly arterial complications that are so fatal fifteen or twenty years after infection. (L. F. Barker.)

## KIDNEYS

Pathologists are rather doubtful as to the existence of a true syphilitic nephritis, but it is by no means uncommon for a patient in the secondary stage to have albumin and casts in the urine, probably as a result of the irritation caused by the effort of the kidney to eliminate the toxins produced by the spirocheta.

## BONES AND JOINTS

The bones are seldom affected until the tertiary stage when they frequently become diseased.

The bones most commonly attacked are the skull, tibia, and fingers.

Two processes are recognized:

1. The inflammation begins in the periosteum which is separated from the underlying bone by the inflammatory infiltration.

The underlying bone deprived of its nutrition becomes necrotic, the skin above ulcerates and sloughs, and in time the sequestrum separates and is discharged through the broken skin surface.

Instead of becoming necrotic, however, a new growth of spongy bone may form on the surface of the old cortex, which appears like pumice stone when the bone is dried.

It is the formation of these osteophytes that occasion the thickenings with rough irregular surfaces, which are noted on the shafts of long bones in museum specimens.

Instead of being formed on the surface of the bone in connection with the periosteum, the new bone formation may take place along the Haversian canals and cancellous bone in the interior so that the shaft of the bone becomes dense and ivory-like and the whole bone is much heavier than normal. This process occurs particularly in the long bones, clavicles, sternum, etc.

2. Gummata may form in the marrow cavity singly or in such numbers as to involve the whole marrow cavity.

The cortex is often attacked and eroded, but the periosteum produces a new layer of bone to repair the damage, forming a spindle-shaped dilatation of bone which resembles the end result of an ordinary myelitis.

Syphilitic dactylitis is brought about by gummatous osteoperiostitis causing enlargement with rarefaction and internal destruction of the bone in the phalanges.

## JOINTS

Joint affections are not so infrequently met with in tertiary syphilis.

The disease may originate in the synovial membrane or in the ends of the bones forming the joint.

The Charcot joint of tabes is not due to the infiltration of the joint by a gumma, but is probably an arthritis caused by traumatism in a joint whose innervation has been impaired as a result of the tabetic process in the spinal cord.

## NERVOUS SYSTEM

It is now known that infection of the nervous system begins at an early period in syphilis with the generalization of the virus through the circulation. This has been demonstrated by lumbar puncture which showed the pathologic alterations with leucocytosis and an increase of globulin in from 40 to 70 per cent of patients in the secondary stage. In a few cases of inherited and secondary syphilis and syphilis of the nervous system in the tertiary period, the spirochetæ have been actually found in the spinal fluid on puncture. Noguchi found the spirochetæ in the spinal cord in one case out of twelve, and he also found them in the brain in general paresis. This proves positively a fact that clinicians had long suspected, that general paresis and tabes are manifestations of a late, but active syphilis. It has been observed for a long period as an established clinical fact that syphilis of the nervous system was more apt to develop later in patients who had no secondary symptoms, or in whom the secondaries were very mild. As the choroid plexus in the spinal cord acts as a filter in preventing substances from passing from the blood into the spinal fluid, it is still a question whether the spirochetæ are deposited in the spinal canal during the general invasion of the early secondary period, or whether they reach the nervous system through some other channel. It has been suggested by Head and Orr and Ross that the organisms travel along the perineural lymphatic space which surrounds every spinal nerve and extends along the roots to the pia mater. These spaces are in connection with the pia and also with the adventitial lymph spaces of the perforating vessels. These anatomic facts may explain the occurrence of the spirochetæ within the spinal canal.

## SYPHILIS OF THE BRAIN

Distinct syphilitic lesions of a low grade may exist in the brain for years without causing symptoms. The brain may be affected in three ways, either through (a) a syphilitic arteritis; (b) a gummatous meningitis, or meningoencephalitis; or (c) gummata in the substance of the brain.

*Syphilitic arteritis* as it occurs in the brain is of the same type as elsewhere, but as there is no collateral circulation in the brain, the brain cells supplied by the diseased arteries undergo softening and degeneration. In other forms of arteritis rupture takes place with consequent hemorrhage and clot formation, as in apoplexy.

*Gummatous meningitis* is generally located at the base of the brain and is a very common lesion in nervous syphilis. It originates as a leptomeningitis and extends to the overlying dura. Not infrequently *isolated gummata,* the size of a walnut or larger, are formed in the brain substance. They are located in the cortex of the brain connected with the arachnoid and dura, and may even penetrate through the skull. The brain is not pushed away, but is actually invaded and infiltrated by the new growths. In rare instances small or miliary gummata may be found scattered through the brain.

In cerebral syphilis headache and signs of intracranial pressure are often present.

The cerebral nerves at the base of the brain are often affected, causing eye-muscle paralysis and symptoms denoting injury of the optic chiasm or tract. Finally, neuralgia or paralysis, deafness and difficulties of speech may occur with involvement of the particular nerves presiding over these functions. If the meninges covering the convexities of the brain are the seat of the inflammatory process, the evidences of cortical irritation may appear as a monoplegia or a Jacksonian epilepsy.

## THE SPINAL CORD

The spinal cord, like the brain, may be attacked by a syphilitic arteritis of the arteries of the spine, causing transverse lesions of the cord, and softening, or the disease may manifest itself as a gummatous meningomyelitis involving the anterior and posterior roots and cord, and giving rise to neuralgia, paresthesias, root pains, muscular atrophies, paraplegia, etc.

## PARESIS

A distinction between paresis and tabes is no longer held, for it has been found that the etiology is the same and the pathology identical, the difference in symptoms being due to the localization of the disease and the particular tissues involved. It is known today that when meningitis develops in the cortex and involves the substance of the brain, paresis is caused. When meningitis involves the posterior roots of the cord and is accompanied by secondary degeneration of the posterior columns, tabes occurs.

The difference in the behavior and prognosis between meningitis and tabes and paresis is that while all are caused by cerebrospinal syphilis, the first is occasioned by a superficial hyperplastic lesion of the coverings of the brain, which can be repaired; the other two cause a parenchymatous degeneration and destruction of nerve cells, which can not be restored or replaced.

Paresis, then, is understood to be a combined meningitis and encephalitis with cellular infiltration of the lymph spaces and secondary degenerative changes and vascular disease.

Noguchi and Moore have demonstrated the spirocheta pallida in the brain of paralytics, and the disease is proved to be the result of the acute and chronic lesions caused by the proliferation of the spirocheta in the cerebral cortex.

The growth and increase of the organisms occurs in successive crops, and is most frequently located in the anterior part of the brain. As the proliferation in one focus ceases and the parasites die, another may begin in a hitherto intact convolution, thus explaining why a distinct and advanced lesion may not contain large numbers of parasites. Probably the epileptiform attacks characteristic of general paresis are connected in some way with the proliferative climaxes on the part of the spirochetæ, particularly when located in motor zones.

## TABES

The pathologic changes in tabes are found on postmortem examination to exist in a chronic meningitis about the posterior roots between the ganglion and the cord, leading to disease of the roots and secondarily to the posterior columns. Through the inflammatory infiltration and pressure, degeneration of the afferent fibers extending to the posterior columns, occurs, and from this point an ascending degeneration takes place, for it is a physiologic law that a destruction of the neuron is followed by a degeneration along the entire course of its distribution. These changes are today known to be due to the Spirocheta pallida, thus confirming the clinical opinion held by Erb and other neurologists before the discovery of the spirocheta.

### BIBLIOGRAPHY

Barker, Lewellys F.: Am. Jour. Syph., Jan., 1917.
Brooks, Harlow: Am. Jour. Med. Sc., Oct., 1913; New York State Jour. Med., April, 1916.
Fordyce, J. A.: Am. Jour. Med. Sc., June, 1915; New York State Jour. Med., Nov., 1915.

**Gardner, Faxton E.:** Med. Times, May, June, July, 1916.
**Howard, Tasker:** Am. Jour. Med. Sc., July, 1917.
**Levison, L. A.:** Aortitis, Am. Jour. Syph., Jan., 1918.
**MacCallum:** Pathology, 1917.
**Nichols and Hough:** Jour. Am. Med. Assn., Jan. 11, 1913.
**Noguchi and Moore:** Jour. Exper. Med., xvii, p. 232.
**Nonne:** Syphilis of the Nervous System, 1916.
**Power and Murphy:** System of Syphilis, 1914.
**Thompson, Loyd:** Syphilis, 1916.
**Warthin:** Jour. Am. Med. Sc., October, 1916.

# CHAPTER XLVIII

## CONGENITAL SYPHILIS

Congenital syphilis may be regarded as a form of spirocheta sepsis or an acute invasion of the entire system of the infant, which is overwhelmed by the numbers of the organisms, which are found in great abundance in nearly all the organs.

In 53 syphilitic infants Bab found the spirocheta in the lungs in 87.5 per cent; in the pancreas in 80 per cent; in the skin, nose, and eyes in from 66.7 to 25 per cent. They are usually most abundant in the liver, adrenals, and intestinal wall.

In the *liver* they are universally present, and usually in very large numbers, as well as in the suprarenal glands, and these organs may be regarded as predilection sites for the spirocheta.

In the *spleen* the number of spirochetæ is never very great and the distribution is irregular. The scarcity of spirochetæ is regarded by Levaditi as a result of the energetic destruction of the parasites in the spleen.

Spirochetæ have been found in the *eye lesions* of early cases of congenital syphilis, such as keratitis and iridocyclitis, and also in the optic nerve itself. It is therefore probable that the various stigmata of congenital syphilis are the result of the direct working of the spirocheta.

In all the *skin lesions* of early congenital syphilis, whether maculo-papular or pemphigoid, spirochetæ are present in enormous numbers

The *maternal portion of the placenta* is almost always free fr[illegible] organisms, but they are found in the blood vessels and stroma of [illegible] fetal villi, and also in the arterial and venous walls of the umbili[illegible] cord.

Before the development of the Wassermann reaction and the d[illegible]covery of the Spirocheta pallida, the method by which the child [illegible] utero became infected with syphilis was not clearly understood, a[illegible] many theories to account for the infection developed.

Since the cause of syphilis and the ability to diagnose it in i[illegible] latent period by the Wassermann reaction became known, the ma[illegible]ner in which the infection of the fetus occurs is now fairly well u[illegible]derstood. It is today believed that the spirochetæ are always co[illegible]veyed from the mother to the child through the placenta an[illegible]

Gardner, Faxton E.: Med. Times, May, June, July, 1916.
Howard, Tasker: Am. Jour. Med. Sc., July, 1917.
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MacCallum: Pathology, 1917.
Nichols and Hough: Jour. Am. Med. Assn., Jan. 11, 1913.
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Thompson, Loyd: Syphilis, 1916.
Warthin: Jour. Am. Med. Sc., October, 1916.

child is probably stillborn, and the following one may be born alive, but with the syphilitic taint.

Children that are stillborn are usually retained long enough in the uterus after death to become macerated. The epidermis is stripped off or raised up into large bullæ. The liquor amnii is discolored, brown, and foul-smelling. On examination of the infant's viscera, upon the autopsy table, they are found to be the seat of the characteristic changes of syphilis.

Occasionally children are born of syphilitic parents who have all the manifestations of a florid syphilis upon them, but usually one or two weeks pass before the syphilis becomes visible. In appearance these children are usually ill developed, small, and of light weight. The skin is faded, and they look like little, shriveled old men.

If the parental syphilis is still older, the children may be born apparently healthy, and develop syphilitic manifestations later. The most common time for their appearance is within the first three months after birth and rarely later than the first six months.

Although children born of syphilitic parents may escape the inheritance of an active form of syphilis by reason of a certain acquired immunity, they may receive a **diathetic taint,** which does not make itself evident by any characteristic manifestations. These children have a feeble constitution and suffer from a general want of mental and bodily development which is particularly notable at the time of puberty, and epilepsy, idiocy, and hydrocephalus are today regarded as due to hereditary syphilis.

The children develop slowly, remain small, and are thin and anemic, and without the power of resistance against accidental disease. The intelligence is often deficient, and such instances are described as cases of **late hereditary syphilis.**

**Termination of Pregnancies in a Syphilitic Mother.**—I. First pregnancy terminates in an *abortion.*

II. The next pregnancy results in the premature birth of a syphilitic child.

III. Then follows the birth of a full-term child, which has syphilitic manifestations.

IV. Next a child is born at full term, which subsequently develops manifestations of syphilis.

V. Finally, healthy, full-term children are born, which remain healthy and free from syphilis.

## Course

Infants with congenital syphilis are generally undersized and of feeble vitality and show a tendency to gastrointestinal and nutritional disturbances and infection of the respiratory tract.

The signs of congenital syphilis may be present at birth or may not appear for several weeks; usually they appear before the end of the second month and if the child reaches the age of three months without presenting signs of syphilis it is probably free from infection.

The course of inherited syphilis resembles that of the acquired disease, except that it does not begin from a chancre and that the lesions peculiar to the secondary and tertiary periods appear simultaneously.

The most important clinical signs of syphilis which may be present at birth are:

1. Snuffles.
2. Vesicular eruption in the hands and feet.
3. Enlargement of the spleen.

When a child is born apparently well, but develops syphilis later, one of the most striking symptoms of the impending outbreak is the nasal catarrh, causing **snuffles.** This is soon followed by an ulceration of the mucous membrane of the larynx, which causes a **hoarse cry.** Mucous patches occur about the skin of the mouth, which interfere with the child's nursing, and the nutrition suffers.

The **eruptions upon the skin** resemble those of acquired syphilis. A *macular eruption* often occurs upon the chest, and a *diffused erythematous redness*, resembling eczema in outward appearance, is often seen about the mouth, navel, and parts where the skin is liable to chafe against another opposing surface, such as in the groins, axillæ, or nates.

If the patient is not treated, and in severe cases, the eruption develops into *papules.* The soles of the feet and palms of the hands become the seat of copper-colored papules, which desquamate and are changed into deep *fissures.* The papules located about the mouth, anus, and genitals are apt to become transformed into luxuriant and vegetating **condylomata.**

An eruption which is unique, inasmuch as it does not occur in adults, but only in children, is *syphilitic pemphigus* or *pemphigus neonatorum*, in which large *bullæ*, or blebs, form on the palms and soles, although it sometimes occurs over the entire body. Its formation is explained by the delicate character of the epidermis and the readiness with which serum collects underneath it and raises it from the derma, forming a vesicle or bulla.

Pemphigus is either present at birth or develops in the first week, and the children so affected usually die.

All the above-mentioned eruptions may exist at the same time, and the symptom of *polymorphism* is usually more marked in inherited than in acquired syphilis.

**The viscera** are affected in inherited syphilis even more frequently than in the acquired form.

Enlargement of the spleen although not always present at birth develops later and may be regarded as an almost constant sign of congenital syphilis. The *liver* is often the seat of a form of *cirrhosis* occasioned by its infiltration with newly formed connective tissue, or *gummata* may exist in various portions of the gland. The *pancreas* is affected in a similar way. The *lungs* may be the site of gummata, and as a consequence of periarteritis the framework of the alveoli becomes infiltrated with new cells in various areas, causing *white hepatization.*

A very characteristic feature of congenital syphilis is **osteochondritis,** which is considered by some authorities as pathognomonic. It consists in an overgrowth of the cartilage which is interposed between the epiphyses and the diaphyses of the long bones.

The favorite localizations of this process are the lower ends of the humerus and either lower end of the femur or upper end of the tibia, and occasionally in the shoulders or wrists. By palpation, the enlarged cartilage can be felt surrounding the bone like a collar. The ultimate course of the inflammation may end in suppuration and necrosis and, after extrusion of the dead bone, the injury is repaired by the abundant formation of new bony tissue, called an *osteophyte.*

Pseudoparalysis of certain groups of muscles often accompany the bony changes.

The paralysis may be caused by: (1) an extension of the inflammation of the muscle, causing extreme pain on motion, (2) extension of the infiltration to the muscles interfering completely with their movement, (3) separation of the diaphysis from the epiphysis.

The periosteum of the fingers is often affected and an olive-shaped swelling occurs in the middle joint of one or more phalanges which is spoken of as *dactylitis.*

The inflammation involving the cartiilages often travels to the **joints,** and a serous or purulent synovitis occurs. **The teeth** of the second set are deformed by a vertical notching and peg shape of the central incisors.

**Hemorrhagic syphilis** exists at birth or else makes its appearance within the first month. It is a condition in which the blood is effused under the skin or mucous membranes, forming large purpuric spots. It is not infrequently met with, and is due to the endarteritis, which permits the escape of blood in greater or less quantities.

In all the lesions above described the spirochetæ are found, usually in great abundance, and the disease can be best described as an acute invasion of the entire system with these organisms.

**The nervous system** suffers as well, and epileptiform convulsions, headache, mental disturbances, idiocy, tabes, and progressive paralysis are frequently seen in syphilitic children.

Hydrocephalus is frequently met with in infants and usually develops in the third or fourth month, but may appear soon after birth.

In the later periods of the disease if the infant survives and reaches childhood, the central nervous system is affected in a large number of cases.

In a series of 100 cases, Veeder found as follows:

| | |
|---|---|
| Mental deficiency | 23 |
| Cerebrospinal syphilis | 14 |
| Hemiplegia | 6 |
| Epilepsy | 5 |
| Spastic paraplegia | 4 |
| Chorea | 2 |
| Hydrocephalus | 2 |
| | 56 |

Interstitial keratitis was found in 24 cases and periostitis and arthritis in 14 cases.

## Diagnosis of Late Congenital Syphilis

In the preceding section we have described the conditions found in infants with congenital syphilis which are to be found at birth and during the early months of life.

The Wassermann reaction for the purpose of making a diagnosis in these cases is invaluable, being positive practically in 100 per cent of the late cases in childhood.

Certain points are of use in making a diagnosis of inherited syphilis at an age advanced from infancy. The most reliable sign is the presence of Hutchinson's teeth. The central upper incisors of the second set are the most characteristically affected. The deformity consists in the *peg shape of the teeth* and the ***vertical notching in their lower edges.*** Jonathan Hutchinson considers them pathognomonic of inherited syphilis, and describes them as follows: "The central incisors are short and narrow, with the broad vertical notch on their edges and their corners rounded off. Horizontal notches or furrows are often seen, but as a rule have nothing to do with syphilis."

The teeth as described are only in evidence until the twentieth or twenty-fifth year.

In the subjects of inherited syphilis the *skin* is thick, pasty, and opaque, or occasionally remarkably soft and silky. At the angles of the mouth may sometimes be noticed *linear scars,* radiating out into the cheeks. The *bridge of the nose* is usually broad and low, and a want of firmness in the cartilaginous septum, which allows the nose to be shaken about too easily, is sometimes observed.

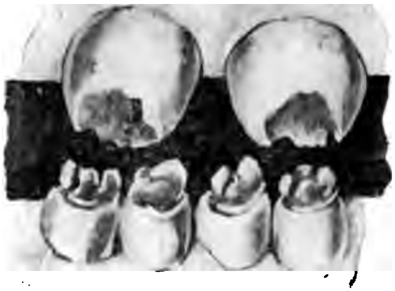

Fig. 321.—Hutchinson's teeth. These teeth have been recently cut, and the central notch is well outlined, but the thin and unprotected dentine has not yet crumbled away.

The *eyes* are liable to be affected, and the occurrence of a well-marked **interstitial keratitis** is regarded as *pathognomonic* of inherited syphilis. The *skull* is apt to be squared in shape and to show low protuberances in various parts. The *long bones* are often the seat of periosteal thickenings or nodes, and the phalanges and neighboring joints may be affected by a globular swelling, a form of periostitis or ostitis, to which the name *dactylitis* is given.

The *ears* are occasionally affected, and symmetrical deafness, which has occurred without discharge from the ears is said to be strong corroborative evidence of an inherited taint.

The periosteum of the tibia is very often inflamed and thickened and the skin overlying it stretched and shiny, and the bone itself thickened in its entire length. The inflammation of the periosteum may subside or the new inflammatory infiltration may become converted into bone with the result of causing a permanent deformity of the tibia.

The three most typical symptoms have been grouped together under the name of **Hutchinson's triad,** and consist in (*a*) the interstitial keratitis, (*b*) deafness from disease of the labyrinth, and (*c*) Hutchinson's teeth.

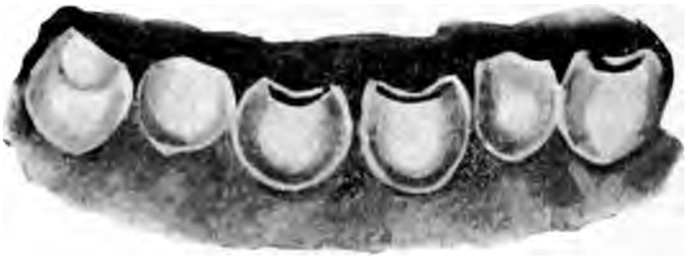

Fig. 322.

The clinical signs are so well marked that in most cases diagnosis is easy, but in doubtful ones the Wassermann reaction will clear up the question with precision.

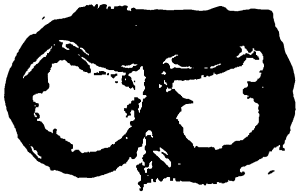

Fig. 323.

Figs. 322 and 323 show later stages of the process after the dentine has been destroyed. The characteristic peg shape, with the vertical central notch, is clearly shown.

The *mortality* is greater in inherited syphilis when symptoms occur soon after birth, and the children affected with pemphigus nearly all die.

Intestinal diseases are a frequent cause of death, and intercurrent diseases are very apt to result fatally in childhood, so that it is unusual to see an old man with the stigmata of inherited syphilis.

## Treatment

With the treatment of an adult syphilis, salvarsan (old) should be resorted to at once, as soon as the patient comes under observation; but in congenital syphilis it is not so easy to decide on the manner of treatment. In young children the veins are small and the salvarsan is technically difficult to give, and there is also some danger of causing arsenical poisoning in young infants. In spite of these dangers and difficulties mentioned, in severe cases of congenital syphilis, especially those in which the disease appears early and the manifestations are so marked as to give rise to a grave prognosis, it is better to attack the disease vigorously with salvarsan at once, for the purpose of sterilizing the tissues of the spirocheta rapidly, rather than to wait for the slower effect of mercury. Although the old salvarsan is generally preferred in adult syphilis, pediatrists now advise the use of neosalvarsan for injection in children. In the newborn the dose recommended is .03 or .05 grams, according to the size and vitality of the infant. In older infants 0.1 grams, and in the latter part of infancy and early childhood 0.2 grams. The administration of neosalvarsan should be repeated once in ten days. The solution should be made by using 10 c.c. of distilled water to dissolve 0.1 grams of neosalvarsan, which is injected with a syringe into an accessible vein. If it is not practicable to use the veins in the arm, the injection may be made into the jugular vein or into the longitudinal sinus through the anterior fontanelle.

Charles Hunter Dunn describes a simple method of injecting the solution of neosalvarsan with a hypodermic needle and Luer syringe, connected with a rubber tube.

The syringe is introduced into the lateral sinus at the posterior angle of the fontanelle.

The entry of the point of the needle can be felt by a sudden giving way of the walls of the sinus, and if the needle is in the vein, blood flows into the tube. The syringe is then attached and the neosalvarsan slowly injected. Distention of the veins of the scalp is a sign that the injection is being made too rapidly.

After the course of neosalvarsan is completed, the treatment should be followed up with mercury. While pediatrists now believe that it is better to treat most cases of congenital syphilis with intravenous injections of neosalvarsan, an exception may be made in those cases where infants who are born apparently healthy develop the disease in a mild form, occurring some weeks after birth. Such cases always respond to mercury; and on account of the difficulty in administering, and the slight danger of poisoning accompanying the treatment with neosalvarsan, the mercurial treatment may be used as described below, because in children as in adults it is not sufficient to depend upon salvarsan alone for the cure of syphilis, but the treatment must be completed by a vigorous course of mercury.

If too much irritation is caused and an eczema follows, the inunction must be suspended and the drug given by the mouth.

In children who develop pemphigus in the first or second week, sublimate baths are effective. A wooden tub should be used, with from 15 to 30 grains of the salt dissolved in the water.

Treatment by *hypodermic injection* has been used by Immerwohl, of Roumania, successfully. He uses the following solution:

℞ Corros. sublimati,
Sodii chloridi ..............of each gr. iij
Water .......................... ♏ clxxx

Sig.: Each minim represents $\frac{1}{60}$ grain, and an injection of from 2 to 4 minims is made once a week, continuing from four to six weeks.

It has been thought possible to treat an infant affected with syphilis by giving mercury or salvarsan to the mother and allowing the child to nurse from her breasts. It was supposed that enough of these drugs would be eliminated in the milk, to control the syphilis in the child. The quantity, however, eliminated in the milk is too small to be of very much avail, and we are obliged to give specific treatment in the other ways above described.

As we have already found, in infantile syphilis the division into secondary and tertiary periods is not clearly defined, and the lesions peculiar to both periods often exist at the same time. On this account **iodide of potassium** is often called for by the appearance of tertiary lesions at an early date in the course of the disease. Iodide of potassium may be given in doses of gr. j three times a day, or it may be necessary to give it in much larger doses, if the lesions are severe. After one course of salvarsan and mercury relapses follow and so the courses of treatment must be repeated at intervals in order to insure a definite cure and not merely a temporary blanching of the active symptoms.

It is eminently desirable to maintain the nutrition of a syphilitic child, and this can best be accomplished by allowing it to nurse from its own mother. The various forms of artificial feeding are less useful, and should only be resorted to when the mother's milk is insufficient.

**Duration of Treatment.**—No definite rules can be laid down for the length of time required for treatment. It is considered best to continue for at least two years, with occasional intermissions, but treatment should only be stopped after all manifestations have ceased.

The Wassermann reaction offers a guide to the amount of treatment here as well as in adults.

In the case of a child two weeks or more of age, *calomel,* given internally, is found to be a satisfactory remedy. It may be given in doses of from 1/10 to 1/8 grain three times a day.

When the child is three months old, the dosage may be increased to 1/6 grain, three times a day, and as the child grows older, 1/4 or 1/3 grain of calomel may be given three times a day.

The administration of the drug should be continued until the syphilitic manifestations have disappeared, and the green color of the feces which occurs may be disregarded.

Other preparations of mercury are also administered internally with good results; viz., the bichloride of mercury, grain 1/96 to 1/60, or hydrarg. cum creta, gr. j to vj, three times a day.

With children, as in the case of adults, *inunctions* are a very useful mode of giving mercury, as in this way digestion is not interfered with.

It is not necessary to rub the ointment all over the body, as in adults, but 30 grains of mercurial ointment, mixed with an equal quantity of lanolin to assist absorption, may be spread on the child's binder, which surrounds the abdomen, and allowed to remain in contact with the skin for two or three days. At the end of that time the ointment may be renewed.

## BIBLIOGRAPHY

Churchill, Post, Jeans De Buys, and Sylvester: Symposium on Syphilis, Am. Jour. Dis. Child., October, 1916.
Dunn, Chas. Hunter: Pediatrics, 1917.
Heimann: New York Med. Jour., Sept. 23, 1916.
MacCallum: Pathology, 1917.
Power and Murphy: System of Syphilis, 1914.
Rostenberg: Med. Rec., July 1, 1916.
Veeder: Am. Jour. Med. Sc., Oct., 1916.
Wile: Jour. Cutan. Dis., Sept., 1916.

# CHAPTER XLIX

## CLINICAL DIAGNOSIS OF SYPHILIS

The question of diagnosis is an important one, both from the standpoint of therapeutics and also from the necessity of guarding other persons against a contagious disease. Of course, it is more difficult to make a diagnosis many years after infection than when the initial lesion, mucous patches, and eruptions are all present. It is always better to conduct the examination in a systematic manner, and begin by taking the **history of the case.**

We should inquire if the patient has suffered from: (*a*) a venereal sore with lumps in the groin; followed by (*b*) a rash upon the skin, (*c*) sore throat or sores in the mouth, (*d*) pains in the bones and skull which were worse at night, (*e*) sore eyes, and (*f*) in women the occurrence of abortion or stillbirths.

It is important to bear in mind that syphilis is not always acquired by venereal contact, and the initial lesion may not have been on the genital organs. We should also remember that the early manifestations may have been so slight, particularly in women, as not to have been noticed. It is also well to remember that in men there is a possibility of a chancre being located within the urethra, without causing any symptoms except a slight gleety discharge, which might be mistaken for a urethritis, and the possibility that syphilis may be transmitted by direct inoculation of the spirocheta into the blood or lymphatic streams without the previous appearance of a chancre, which has been demonstrated by animal inoculations, must also be considered.

After obtaining the history the examination of the patient should be proceeded with.

In recent years the laboratory diagnosis has supplemented or supplanted the clinical methods of determining the presence of syphilis. In former times the diagnosis was made purely on the clinical findings and the older practitioners became very skillful in observing the data and drawing conclusions, and from a few apparently unimportant symptoms a correct diagnosis was established.

The tendency of today to depend exclusively upon laboratory findings in making a diagnosis in diseased conditions of all kinds is strongly to be deprecated. I believe that we should make our diagnosis as far as possible from observation of the clinical facts and then confirm it by the laboratory methods.

In syphilis, which is characterized by active symptoms, alternating with periods of latency, during which no manifestations are present, we must frequently depend entirely on the laboratory for a diagnosis, but in all cases, at some time or another, manifestations are available for the skilled observer so that he may be positive of his ground.

## PRIMARY STAGE

In the primary stage the only symptoms are the initial lesion or chancre and the enlarged lymphatic glands adjacent. The chancre may assume various forms, but its characteristic feature is always the induration.

The amount of induration varies greatly in different cases. Where it is only slight it occasions the so-called split-pea variety of chancre. When the induration is spread out thinly under the skin it occasions the parchment form. Where the induration is considerable in amount a typical Hunterian chancre develops. In all the cases, however, the feeling of the induration is always the same, and the trained finger is capable of recognizing an ivory hardness under the tissues.

The second point of importance in the diagnosis is the invariable enlargement of the adjacent lymphatic glands, and a chain of small, round, hard, freely-movable lymphatic glands, resembling a rosary in feeling, is very characteristic.

The third point upon which we depend for a diagnosis is a history of a three weeks' incubation of the sore.

In a typical case by considering these three points the diagnosis is easy, but many of the cases are atypical.

Chancroids, especially when cauterized, take on an inflammatory hardness of their bases. The edema of the prepuce as the result of paraphimosis is sometimes misleading. Chancroids of the meatus or sulcus coronarius are very apt to become the seat of inflammatory induration, while a chancre located half an inch or an inch within the urethra may be easily mistaken for a gonorrhea until more careful palpation of the urethra discloses the induration.

Mixed sores in which a double infection with the spirocheta pallida and the bacillus of Ducrey have occurred are exceedingly difficult of diagnosis and can only be judged correctly by the appearance of secondaries.

Extragenital lesions are notoriously difficult of diagnosis, and a chancre of the lips, tongue, nipple or finger requires great care in examination in order to avoid making a serious error, although the three points above mentioned—the character of the induration, the time of incubation, and the rosary-like swelling of the nearest lymphatic glands are great diagnostic aids.

Gumma of the penis occurring as a tertiary lesion is not infrequently mistaken for a primary sore or even a reinoculation with syphilis, and finally in absence of other means of determining the specific character of a suspicious sore a diagnosis may be made by *confrontation,* that is, seeking out and examining the person by whom the patient was supposedly infected.

If this individual shows evidences of syphilis, the nature of the sore under observation is made clear.

## SECONDARY STAGE

The character of the secondary period of syphilis is that of a general infection with spirochetæ which are disseminated throughout the entire body and resembles all the acute eruptive diseases due to a specific organism. Unlike the other eruptive fevers, the active cause does not die out in the body, leaving a state of immunity, but it has a tendency to persist, and the disease recurs from time to time in more aggravated forms, of general distribution and accompanied by pathologic changes in the various structures of the body.

Diagnosis in the early period is usually not difficult, especially where the initial lesion has been under observation. Five or six weeks after the first appearance of the sore, prodromal symptoms are noted, and slight fever, rheumatic pains, malaise and anemia are generally followed by manifestations on the skin and mucous membranes.

Affections of the skin, or syphilides, are most important helps to diagnosis, and next to them come those of the mucous membranes of the mouth or throat.

All secondary syphilides possess certain characteristics which render their recognition easy to the trained eye. Their polymorphism, color and pigmentation, general and symmetrical distribution, mode of grouping, so as to form annular or circular lines, the consistency and color of scales and crusts, and the absence of itching, are all significant points to the experienced student of syphilis, but have little or no significance to the man who sees only an occasional dermatologic case.

To differentiate a late papular squamous syphilide from a psoriasis or pityriasis rosea from a macular syphilide, or to decide that a pustular acne of the back is not a pustular syphilide, or that a drug erythema following the ingestion of copaiba is nonspecific, is not always an easy task.

There are no pathognomonic skin lesions of syphilis, although the moist papules or condylomata of the scrotum, anus, vulva and mammae must all be considered as very characteristic, and the scaly patches on the palms of the hands and soles of the feet, although frequent in syphilis, are also found in eczema, psoriasis and lichen ruber.

Next to the skin, the mucous membranes of the mouth and throat are the most constant seats of the lesions of secondary syphilis. The appearance may be limited to a redness of the fauces, but usually a distinct superficial ulceration or true mucous patch is observed. When located in the fauces and covered with a wash-leather appearing necrotic scab it is impossible to distinguish the mucous patch by inspection from a true diphtheria.

The lymphatic glands throughout the body are very important as evidence of syphilis. In consequence of the infection all the lymphatics are enlarged and those lying superficial at the back of the neck, epitrochlear and inguinal regions are easily palpated and their characteristic enlargement noted. Paramammillar glands, when they occur, which is only once in ten times, are very typical.

The glandular enlargement disappears as the disease grows older and is only useful for diagnostic purposes during the first year of the disease.

Other symptoms occurring during this period are suggestive, such as loss of hair in patches, iritis, early periostitis, nocturnal headaches and affections of the nails. During the later part of the secondary period paralysis of the cerebral nerves, particularly those affecting the eye, persistent neuralgias, and in women, repeated abortions throughout the entire course of the disease, give rise to a strong suspicion of a luetic infection.

## TERTIARY STAGE

In the tertiary stage the spirochetæ are no longer generally distributed throughout the entire body, but become localized in a few structures. All regularity of the manifestations as to chronology, recurrence, course, etc., is at an end and, capriciously lesions become manifest in one or another organ, which may heal spontaneously, or as a result of treatment, but rarely without leaving some loss of substance or some irreparable impairment of function.

The history of infection, of precarious value under any circumstances, is much more unreliable in late than in early syphilis. Often the denial is made in good faith, because time obliterates facts from the memory, or the early symptoms were overlooked and their nature not recognized.

In cases where a distinct history of early syphilis is obtained conclusions may be drawn from symptoms otherwise doubtful. Under any circumstances careful examination may confirm the diagnosis by the discovery of signs of former manifestations. Palpation of the lymphatic glands may show remnants of former enlargement. Characteristic scars on the genitals may be left from the initial lesion, although the chancre usually disappears without leaving any scarring, unless a considerable amount of ulceration of the skin and glans has taken place. Inspection of the entire skin often discloses scars or pigmentation. The anal region and the corners of the lips and mouth often bear old cicatrices, and the neck and lower extremities are the seat of a peculiar pigmentation, although it should be remembered that every scar on the legs is not of syphilitic origin, since varicose or traumatic ulcers never heal without leaving pigmented cicatrices.

The tertiary symptoms on the skin, when visible, while differing in form, distribution, symmetry and course from the secondary lesions, are, in their own way, just as distinct and characteristic. Notably affections of the skin and subcutaneous gumma with resulting ulcers, rupia and tuberculous serpiginous syphilides present a picture which is recognizable as far as the eye can see.

Mistakes can be made, as, for instance, in the case of an ulcerating tuberculous syphilide on the side of the nose resembling lupus or epithelioma, or obstinate patches of psoriasis, or gouty eczema.

The tongue is a favorite seat for tertiary lesions, and differentiation from carcinoma by clinical observation alone is sometimes impossible.

Syphilitic new growths of the testicle and epididymis are not always easy to distinguish from other neoplasms caused by sarcoma, tuberculosis, or even gonorrhea.

Another manifestation of late syphilis is the changes in the finger tips consisting in coldness, bluish color, circumscribed necrosis and exfoliation of the epidermis or even gangrene resembling Raynaud's disease.

Frequent and persistent alterations of great diagnostic value are changes in the periosteum and bones, especially the tibia, ulna and cranium.

In form syphilitic affections do not differ from traumatic and nonspecific forms. Spontaneous pain and nocturnal exacerbations and the peculiar consistency of the gummatous swelling generally reveal their true character.

For the diagnosis of visceral syphilis tertiary affections of the internal organs, the liver, spleen, kidneys, lungs, heart and particularly of the great nervous centers, the spine and brain, almost every positive sign is generally wanting, and it is in these cases that the laboratory methods have been of the greatest aid in modern times for the diagnosis of obscure affections due to an old and latent syphilis.

## DIAGNOSIS BY LABORATORY METHODS

As already indicated, we can often make a diagnosis of syphilis by the clinical findings, but I believe that we should always employ laboratory methods as a control and check against our clinical observations.

The great field, however, for laboratory diagnosis are the cases of visceral syphilis where no signs are obtainable, and by means of the laboratory tests we can make our diagnosis and apply the appropriate treatment.

Under the head of laboratory methods there are five ways of making an examination in order to arrive at a diagnosis.

I. The demonstration of the Spirocheta pallida in the initial lesion or mucous patch.

II. The Wassermann reaction of the blood.

III. The cutaneous or luetin reaction of Noguchi.

IV. The findings in the spinal fluid.

V. Radiography for visceral and bone lesions.

These are, however, all methods which require a high degree of technical skill, pathologic training and a long experience in laboratories before they can be accurately made, and unless they are made correctly it is better that they be not made at all, for an incorrect laboratory report merely serves to obscure the clinical diagnosis.

Another point to be considered is that all laboratories are not absolutely reliable, as some of them are conducted by half-trained men. Needless to say, reports from an unreliable laboratory can not be depended upon and are worse than useless, whereas reports made by a reliable laboratory under the charge of a competent chief are of the greatest aid.

## Demonstration of Spirocheta

As treatment is now begun as soon as the diagnosis of syphilis is established, it is highly important that the spirocheta should be found at the earliest possible moment. This is best accomplished by means of the dark-field illumination, which is regarded by every one as the simplest and the most practical means of finding the spirocheta in the initial lesion.

The spirocheta may also be found by mounting and staining with Giemsa, or sections may be cut from the chancre and stained after Levaditi's method, but these methods are of less value in clinical work.

The method of using the dark-field illumination is simple. The chancre is first washed with salt solution, to cleanse it, and then rubbed briskly with gauze, the resulting blood is sponged away, and in two or three minutes the irritation serum comes from the deeper parts. This is collected on a slide, placed under a microscope provided with the dark-field illumination, and if it be a syphilitic case numbers of spirochetæ can be distinctly seen undulating their way across the field.

## Wassermann Reaction

The introduction of this test has marked one of the great advances in syphilis in this epoch-making age. By means of this test we are able to diagnose positively all the late and latent cases of visceral involvement or doubtful external manifestations in which no clinical data are obtainable.

It is now believed that the old original Wassermann method is the only reliable one to use. Various short cuts have been devised and different modifications introduced, but they have been found to be unreliable and, as a consequence, have all been dropped.

It is to be noted that the Wassermann reaction does not appear simultaneously with the infection, but that it usually makes its appearance in from six to eight weeks later. Occasionally it appears earlier, but the time mentioned is the average, and is just when the blood begins to be saturated with the spirocheta and its toxins.

In secondary syphilis the Wassermann reaction is 100 per cent positive in untreated cases; that is to say, every case responds. Occasionally in untreated cases the Wassermann reaction becomes attenuated, so that as the years go by the disease dies out of itself, but that fortunate occurrence is very rare, and it behooves us to treat these cases vigorously and continuously until the Wassermann reaction becomes negative and remains so for a period of a year or more. In a few late latent cases, however, in spite of treatment, the Wassermann reaction remains a strong positive. Whether this implies that a focus of spirochetæ is stored up somewhere in the body uninfluenced by treatment, we are not sure. The usual explanation for this phenomenon, however, is that there is a fast or permanent fixation of the Wassermann reaction which we are unable to influence by treatment. If, however, a reduction of the strength of the Wassermann takes place after administering salvarsan and mercury it indicates the need of additional treatment, especially if the preceding treatment has been inadequate, and the treatment should be continued until such time as the Wassermann becomes completely negative. If several courses of intensive treatment have been given and the Wassermann remains positive and uninfluenced by the treatment, it may be proper to disregard its positiveness and consider the patient as cured.

### Provocative Injections

There is a diagnostic procedure which is very useful in certain cases where the Wassermann reaction is either negative or weakly positive following a good deal of treatment, but where we still suspect the presence of syphilis, and these are the cases in which the diagnosis can be cleared up by the so-called provocative injections of salvarsan.

It has been found that while a positive Wassermann can be rendered negative by sufficient treatment through the destruction of the spirochetæ, a weak positive reaction may be reactivated by giving a small dose of salvarsan if syphilis is actually present. If there is no syphilis, the reaction will not be influenced.

This has now become a routine measure in doubtful cases and the method of application is as follows:

Salvarsan to the extent of 0.3 gram is injected intravenously and the patient's blood examined on succeeding days. In the presence of syphilis, where the blood was formerly negative or a weak positive, the reaction is changed to a strong positive and this generally occurs in twenty-four hours. If the patient be not syphilitic, the reaction remains negative.

Some doubt has been cast on the value of the provocative injection of salvarsan as a test for syphilis by J. H. Stokes of the Mayo Clinic. He found that instead of all cases of latent syphilis responding to the provocative injection of salvarsan and showing a positive Wassermann afterwards, only 18 per cent of the number experimented with became positive after the provocative injection was given.

### Luetin Reaction

The luetin reaction was devised by Noguchi in 1911. He made different cultures from different strains of spirochetæ, heated them for an hour at 60° C. and added 5 per cent of tricresol. This made a suspension, the spirochetæ were killed and the antibodies and properties which they produced were contained in the suspension. Of this suspension from .03 to .05 c.c. were injected hypodermically in the arm. If the patient were syphilitic a positive reaction made its appearance in from four to five days.

Three types of positive reaction were described by Noguchi.

The positive reaction may appear in one of three forms. (1) The papular form which appears 24-48 hours after the injection. The papule is red, elevated and indurated and from 7-10 mm. in diameter. It is often surrounded by a zone of erythema having an edematous appearance. This papule becomes, in the course of a day or two, stronger, dark red or bluish and then subsides gradually until it has completely disappeared within 7-10 days. In rare cases it may persist for two or three weeks. (2) The pustular form. In its early stages this appears as a papule as in the papular form, but on the fourth or fifth day a small vesicle is formed on the papule and this is soon transformed into a pustule. At the same time the patient feels more or less itching. The pustule opens, a scab is formed which falls off in a few days. The induration also subsides leaving a small scar, always pigmented for a period of several months. (3) The torpid form. This is characterized by the slowness with which the papule makes its appearance. The site of injection becomes discolored after three or four days and two or three weeks later the papule almost always becoming transformed into a pustule appears. Often a rise in temperature is associated with the luetin reaction.

If the reaction is negative a light erythema appears at the site of injection which disappears after 48 hours. Sometimes, after about 24 hours, there is found an elevated, indurated papule surrounded by an erythematous zone which gradually vanishes and disappears entirely by the fifth day leaving a slightly pigmented spot. This should not be confused with a positive reaction.

Noguchi found that a positive reaction did not occur in the primary stage of syphilis, and in secondary syphilis it would only oc when treatment had been given. It was found to be more frequent in occurrence in the latent and tertiary periods.

In a series of experiments carried on by Major H. J. Nichols and Lieutenant-Colonel C. F. Craig, of the United States Army, they found a positive Wassermann reaction in 23 per cent of cases of secondary syphilis and a positive luetin reaction in 38 per cent. In latent syphilis they found a positive Wassermann reaction in 25 per cent of cases and a positive luetin reaction in 87 per cent.

Kafka, in a series of 139 cases, found luetin reactions as follows:

| | | |
|---|---|---|
| Latent general syphilis | 62% | |
| Syphilis, congenital | 72% | (weak reactions) |
| Syphilis, cerebral | 90% | (strong reactions) |
| General paresis | 52% | (weak reactions) |
| Tabes | 100% | (strong reactions) |
| Syphilis, primary | Almost never present | |
| Syphilis, tertiary | Almost always present | |

Most observers are agreed that in untreated syphilis, primary and secondary, the test is valueless. This is explained on the assumption that the luetin reaction is an allergic phenomenon, and depends on the reactivity of the patient to the proteins of the spirocheta. In the first and second stages of syphilis, the disease is so active that the patient is unable to acquire enough allergic power, that is, the antibodies necessary for the reaction. In tertiary, congenital and parasyphilitic conditions, the necessary power of reaction has been acquired, and here the test is of value.

The luetin reaction may be negative in spite of the presence of a strong Wassermann reaction. In syphilitics under energetic treatment the positive Wassermann gradually becomes slighter and finally disappears completely whereas the luetin reaction which, in the beginning of treatment was negative or only faintly positive, becomes intensive at a time when the Wassermann disappears. Such a patient can only be indicated as fully cured when the luetin reaction has become negative. To summarize it may be said that the luetin reaction is a means of recognizing syphilis in the chronic or latent stage when the Wassermann reaction may be negative. A negative luetin reaction in chronic cases with severe symptoms and a positive Wassermann is always of bad prognosis—often the case in paralytics.

Vedder is of the opinion that the Wassermann reaction is much more constant in primary and secondary cases, but that the luetin reaction gives a higher percentage of positives in tertiary, latent, and treated cases.

Care should be taken that the patient has not taken any iodide of potash internally before the luetin is used, for it has been found by a number of observers that well-marked positive luetin reactions occur among healthy, nonsyphilitic persons following the administration of iodide of potash.

The same has been noted following the intracutaneous injection of 1 c.c. of 5 per cent agar agar.

## Lumbar Puncture

A valuable means of establishing a diagnosis when the blood Wassermann is negative in reaction, consists of making a lumbar puncture. This procedure, when carried out under certain precautions, is safe and simple. The patient should be kept in bed for twenty-four hours after the puncture in order to avoid nausea, vomiting, headache and dizziness. In making a lumbar puncture in the presence of cerebral tumors great caution should be observed because of the fact that cases of sudden death have been known to occur from the withdrawal of the fluid.

## Technic of Examination

I prefer to tap the spine with the patient sitting up, although some surgeons place the patient in the recumbent position. In order to get the proper point for the puncture a line is drawn extending across the spine, just above the crests of the ilia on each side. About one inch above this line is a suitable place to introduce the needle. The skin is sterilized, ethyl chloride is sprayed upon the skin to anesthetize it, and a long spinal needle is thrust between the spinous processes of the vertebrae into the spinal cord. The entrance of the needle into the spinal canal can be appreciated by a feeling of sudden giving way of the tissues in front of the needle, and the fact that it is in the spinal canal is confirmed by withdrawing the stylet and allowing the spinal fluid to escape through the needle.

The examination of the spinal fluid after it is withdrawn should be conducted as follows:

First, estimate the pressure.
Second, the cell count.
Third, the globulin test.
Fourth, the Wassermann reaction.
Fifth, the colloidal gold reaction.

*The intraspinal pressure* is taken by noting the rise of the spinal fluid in the glass tube attached to the apparatus. The **pressure pos-**

sesses no particular diagnostic value except that it is increased under certain conditions, like tumors of the brain and hydrocephalus.

*The cell count* is made by counting the number of cells under a microscope to a given amount of fluid.

From none to five white blood cells is considered normal. From 6 to 10 cells is supposed to be a borderland case. Over 10 cells is pathologic. An increase in the number of cells denotes a syphilis of the brain or cord, or some form of irritation in the meninges.

*The globulin test* is also spoken of as Phase One of the reaction of Nonne. The presence of globulin occurs only where there is organic nervous disease. It is not found in normal spinal fluid. The globulin test is useful in differentiating between central and functional nervous disease. It is estimated that globulin is present in from 80 to 100 per cent of all cases of nervous disease caused by syphilis.

There are several tests given for the detection of globulin in cerebrospinal fluid. Among these the tests of Noguchi and of Nonne are probably the more commonly used.

In Noguchi's butyric acid test, 1 part (0.1 or 0.2 c.c.) of spinal fluid is mixed with 5 parts (0.5 c.c.) of a 10 per cent butyric acid solution in physiologic salt solution. This mixture is heated to boiling and immediately 1 part (0.1 c.c.) of normal (4 per cent) sodium hydroxide solution is added and the mixture again boiled for a few seconds. The presence of an increased content of globulin in the fluid is indicated by the appearance of a granular or flocculent precipitate which gradually settles under a clear supernatant liquid. This precipitate appears within a few minutes in a specimen containing a considerable increase in globulin, while two hours may be required to obtain a distinct reaction in specimens weaker in globulin.

Nonne's test is applied in two phases, the first phase being of the greater diagnostic import.

Phase 1: To a small portion of the clear cerebrospinal fluid an equal volume of a hot saturated solution of ammonium sulphate is added. A trace of opalescence or a distinct turbidity, usually appearing within three minutes, indicates a positive reaction. Normal fluids never show any appreciable change with this test, while pathologic types always react promptly.

Phase 2: In case no turbidity is observed in Phase 1, a drop or two of acetic acid are added to the foregoing mixture. A distinct turbidity appears at once. This phase is given, not infrequently, with normal fluids, so that little value is attached to it.

## The Wassermann Reaction in the Spinal Fluid

In diseases of the nervous system, especially of long standing, the Wassermann is not always positive in the blood. In theory it should be positive, but in practice we find that it is not so, and even after a provocative injection of salvarsan we sometimes fail to get a positive Wassermann in the blood, although in general paresis it is positive in 100 per cent of the cases, whereas in tabes it is positive in only 60 to 70 per cent of cases, irrespective of the fact that we know tabes is just as much a disease of syphilitic origin as is general paresis. In the spinal fluid, however, in general paresis the Wassermann is positive in 100 per cent of cases, and in all tabetic cases, if active, the reaction is positive.

After a time, following the subsidence of the active inflammatory process in tabes, there is only a purely degenerative change, and the Wassermann reaction is no longer positive in the spinal fluid in these sluggish degenerative cases.

## Colloidal Gold Reaction

In 1912 Lange described the action of cerebrospinal fluid in various conditions upon a colloidal gold solution.

He demonstrated that the reaction could be used as a delicate test, differentiating normal from pathological cerebrospinal fluids and particularly distinguishing syphilitic from other affections of the central nervous system.

A gold reaction typical of syphilis is nearly constant in cases of syphilis of the central nervous system. The test is more delicate than Wassermann reaction in the blood or spinal fluid, cell count or globulin content.

The test has the advantage that it gives a reaction with pathologic special fluids, due to other causes than syphilis, that is characteristic and easily differentiated from the reaction typical for syphilis.

We should make it a rule to do a lumbar puncture in the case of every patient with symptoms pointing to an involvement of the central nervous system, and also in latent cases of old syphilis, especially those with a negative reaction in the blood, for the purpose of determining if there is a latent process in the cerebrospinal system.

The puncture is not only of value as a point in the differential diagnosis between different diseases of the nervous system, but, in addition, is an index of the activity of the syphilitic process, and, furthermore, it acts as a control as to the effects of treatment.

## SYPHILITIC AORTITIS

In syphilitic aortitis the x-ray affords the most reliable means of making a diagnosis, although auscultatory phenomena are present at an early date.

Slight degrees of dilatation may be determined in the x-ray before other physical signs appear.

The earliest changes are noted just above the semilunar valves in the suprasigmoid part of the aorta. It is necessary for dilatation to have taken place in the aorta, for the accompanying thickening of the vessel or the deposit of lime salts within the tissue of the aortic wall is not sufficient evidence of aortitis without dilatation.

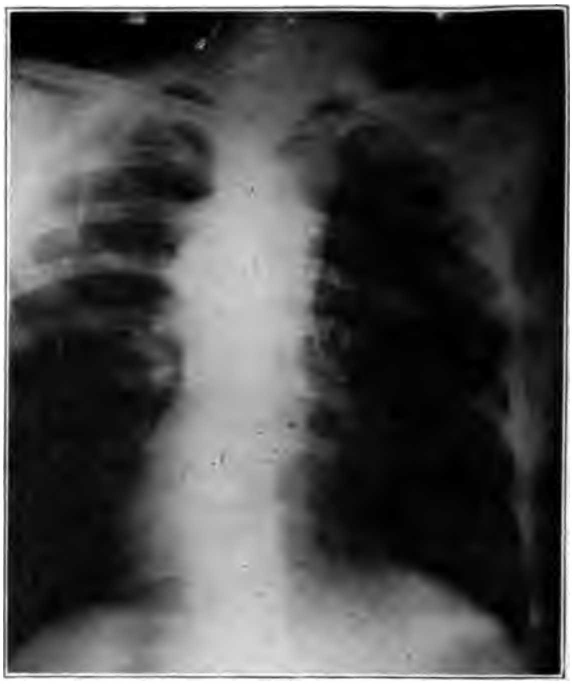

Fig. 324.—Male, age 56, farmer, aortitis with aneurysm. Chief complaint is a sensation of pressure or weight in the throat on lying down, relieved by turning on either side. Has complained of symptoms for eight months. Very dyspneic. Has pain in chest, but most marked in the right shoulder. Has typical brassy cough. The right pulse is obliterated. Wassermann four-plus positive. Blood pressure, 158 systolic, 92 diastolic. The x-ray shows increased length and tortuosity of aorta. There is an aneurysmal dilatation of the aortic arch involving the great vessels. Note glandular mass to the left of the sternum and just above the aortic knob. The heart is not hypertrophied. (Levison, L. A.: Syphilitic Aortitis, Amer. Jour. Syph, 1918, 54, ii, No. 1.)

Changes in the heart shadow denoting hypertrophy also accompanying the aortitis can be seen in the x-ray plate.

## SYPHILIS OF THE LUNG

Consolidation of the lung caused in syphilis must be differentiated from an unresolved pneumonia, tuberculosis, abscess, bronchiectasis and malignant tumors.

The aid of the x-ray in differentiating these conditions has been pointed out by W. Warner Watkins*, who states that lung syphilis is met with in three forms.

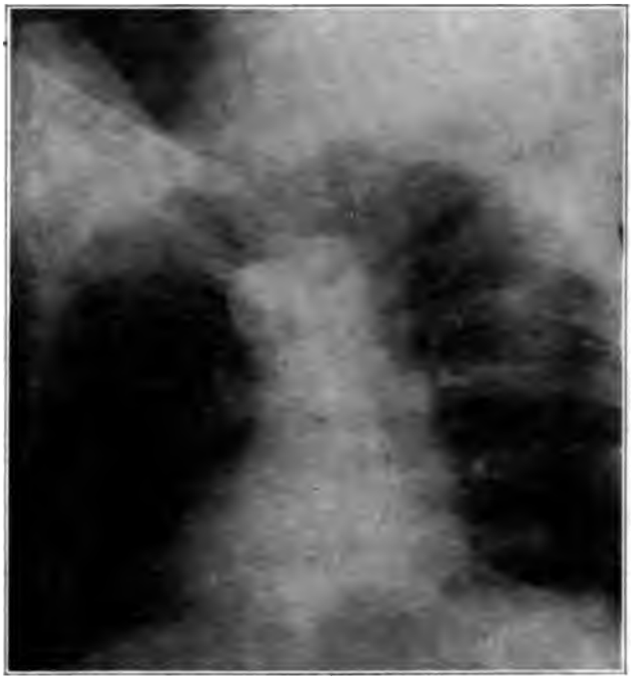

Fig. 325.—Male, age 60, aortitis. Admitted lues 25 years ago. Chief complaint is dyspnea on exertion. Also has severe pains over the precordium coming on in periods and then disappearing for long intervals. Blood pressure average 180 systolic, 100 diastolic. Wassermann four-plus positive.

The x-ray shows a considerable bulging to the left of the sternum, which is due to an increase in the length of the aorta, as well as the dilatation. The great vessels are dilated. The heart shows moderate hypertrophy. (Levison, L. A.: Syphilitic Aortitis, Amer. Jour. Syph., 1918, 54, ii, No. 1.)

1. Syphilitic consolidation resembling an acute interstitial pneumonia which in the radiogram shows a massive shadow involving an entire lobe or a large part of one.

2. Early diffuse sclerosis in which small miliary gummata are

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*Roentgen Diagnosis of Lung Syphilis, Am. Jour. Syph., October, 1917.

sometimes found. The radiogram shows an evenly distributed radiating linear marking or a diffuse specking through the lung.

3. Dense sclerosis—the deposit of elastic tissue causing a contraction and deformity of the lung and a thickening of the pleura. The radiogram shows a pyramidal-shaped shadow in the lower or middle lobe with its base as the hilum and with lance-like projections into the lung substance.

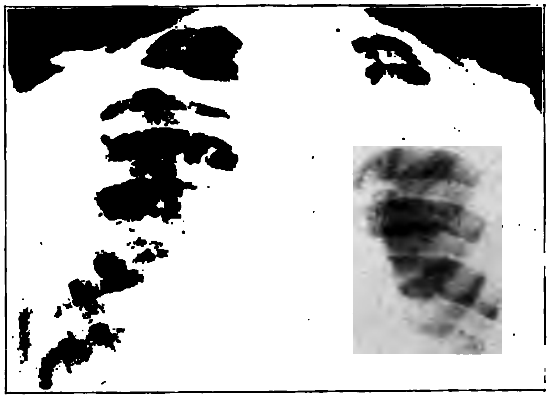

Fig. 326.—Diffuse sclerosis, due to syphilis. (Watkins, W. W.: Roentgen Diagnosis of Lung Syphilis, Amer. Jour. Syph., 1917, i, No. 4.)

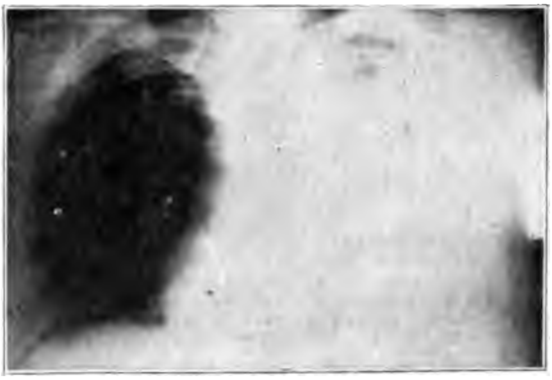

Fig. 327.—Syphilitic consolidation resembling pneumonia. (Watkins, W. W.: Roentgen Diagnosis of Lung Syphilis, Amer. Jour. Syph., 1917, i, No. 4.)

In bronchiectasis and abscess, cavities are the rule, unresolved pneumonia can only be differentiated from syphilis by the clinical history and laboratory methods and the difference between syphilis and pulmonary tuberculosis is usually not marked, but there are distinctive shadows which aid in the differentiation to one accustomed to reading x-ray plates.

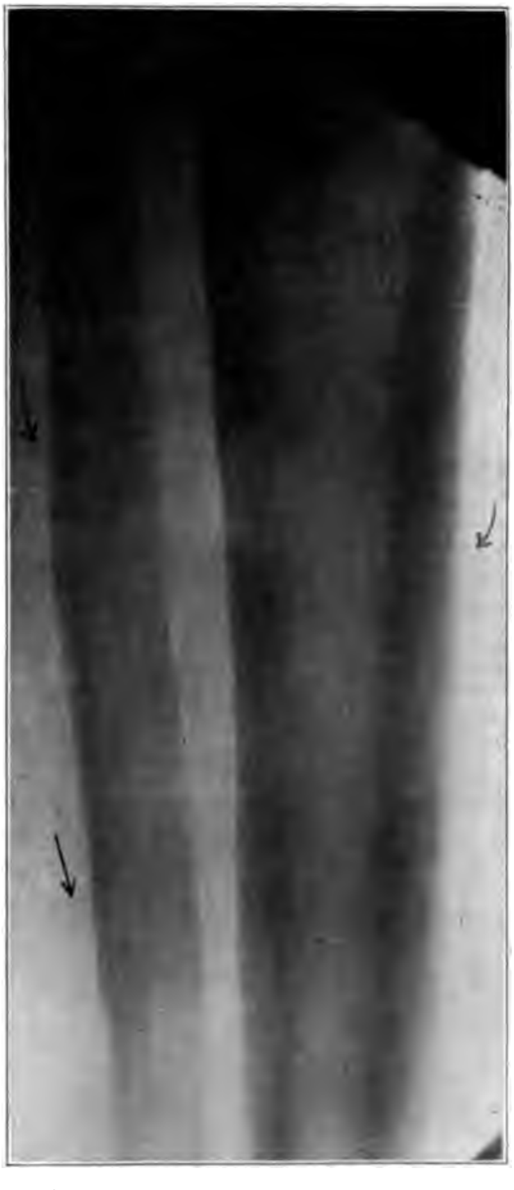

**Fig. 328.**—Male. Specific osteoperiostitis tibia and fibula. No specific history. Extensive injury to soft parts of leg. Healed by specific treatment. (Coues, W. P.: Skeletal Radiography as an aid to the Diagnosis of Obscure Syphilis, Amer. Jour. Syph., 1918, ii.)

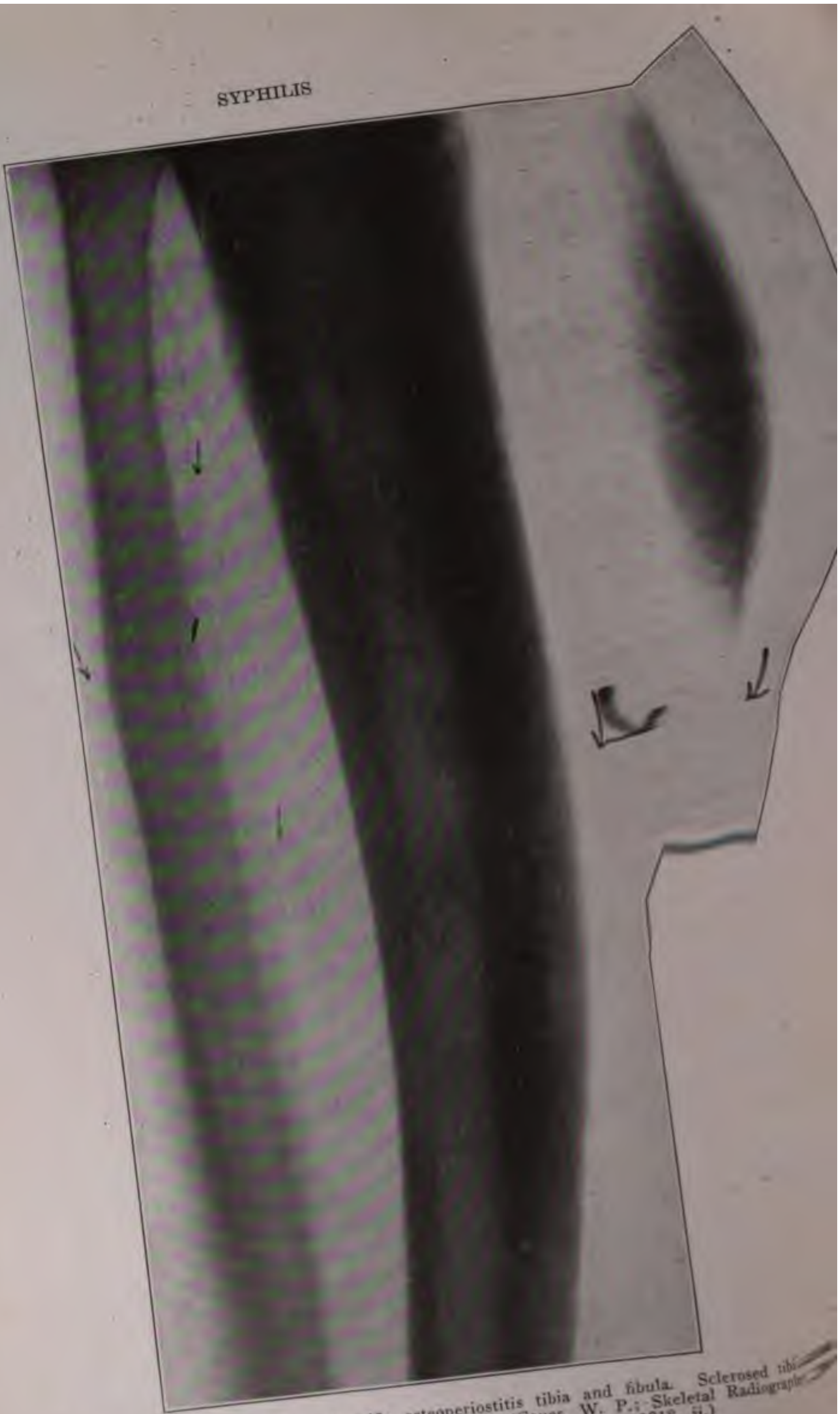

Fig. 329.—Male, 64 years. Specific osteoperiostitis tibia and fibula. Sclerosed tibi vessels. Wasserman negative. No venereal history. (Coues, W. P.: Skeletal Radiograph as an aid to the Diagnosis of Obscure Syphilis, Amer. Jour. Syph., 1918, ii.)

## SKELETAL RADIOGRAPHY

diograms of bones, especially the tibia and fibula and the clav-
nd bones of the forearm and hand, will frequently show the
teristic changes of tertiary syphilis; and in cases when the diag-
is doubtful, a radiogram of the bones often shows periosteal
ning, nodes and other bone changes indicative of syphilis.

### BIBLIOGRAPHY

Wm. Pearce: Am. Jour. Syph., Jan., 1918.
ce, J. A.: New York Med. Jour., Sept., 26, 1914.
: Berl. klin. Wchnschr., Jan., 1915.
Hermann G.: Morrow's System Dermatology and Syphilis, 1893.
, J. A.: Jour. Am. Med. Assn., Sept. 2, 1916.
, L. A.: Am. Jour. Syph., Jan., 1918.
T. R.: New York State Jour. Med., Oct., 1915.
and Levy: Bull. Johns Hopkins Hosp., 1914.
i, H.: Presse méd., 1913, No. 76.
A. G.: Med. Rec., March 1, 1913.
John H.: Am. Jour. Syph., July, 1917.
nd Ellis: Jour. Exper. Med., 1913, No. 2.
Edward B.: Jour. Am. Med. Assn., Nov. 14, 1914.
s, W. Warner: Am. Jour. Syph., Oct., 1917.

# CHAPTER L

## THE WASSERMANN REACTION[1]

The Wassermann reaction, which is an ingenious method of detecting the presence or absence of syphilitic antibody in a blood-serum, was first described by Wassermann, Neisser, and Bruck, in May, 1906, and two weeks later by Ladislaus Detre working independently. The theory of the reaction depends upon the Bordet-Gengou phenomenon of complement fixation or duration. To understand the reaction it is first necessary to be thoroughly familiar with the subject of hemolysis and the various factors on which it depends.

### THE PHENOMENA OF HEMOLYSIS

1. If the fresh serum of a normal rabbit at 37° C. is mixed in a test tube with a suspension of washed sheep's red blood corpuscles in isotonic salt solution, no change will occur, and the solution will remain opaque or, if allowed to stand many hours, the erythrocytes will fall to the bottom, leaving a clear, colorless solution above.

2. If instead of the serum of a normal rabbit we use the serum of a rabbit which has been immunized by intraperitoneal injections of washed sheep's blood corpuscles at intervals of four or five days, it will be noticed that the mixture of immunized rabbit serum and suspension of sheep's blood corpuscles at 37° C., at first opaque, later becomes a transparent, pinkish-red solution. This diffusion of hemoglobin from the sheep's red blood corpuscles is termed hemolysis.

3. If the immunized rabbit serum is now heated to 55° C. for one-half hour and then mixed with the sheep's corpuscles as before, no hemolysis will occur.

If, however, we add some fresh normal guinea pig serum, which by itself has no effect on the sheep's corpuscles, hemolysis will take place showing that the hemolytic power of the heated serum has been restored.

From the above experiments it is evident that hemolysis by serum results from the joint action of two distinct substances which have been termed complement and amboceptor, or immune body.

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[1] For the following chapter, on the Wassermann reaction, the author is indebted to his friend, Dr. Alfred Potter, Instructor in Dermatology in the Long Island College Hospital and Attending Dermatologist to Kings County Hospital and Polhemus Memorial Clinic.

The first is present in all fresh normal sera, and is destroyed by heating to 55° C. for one-half hour. The second is only produced by the introduction into an animal of an antigen, and is not destroyed by heating to 55° C.

An antigen is any substance which when introduced into an animal causes to be formed in the blood of that animal antibodies. The antigen in the above experiments was the sheep's blood corpuscles.

These three substances—complement, amboceptor, and erythrocytes—together complete what is known as a hemolytic system. Hemolysis can only take place when all three are present.

The bacteriolytic system is very similar to the hemolytic system, and consists of (1) bacterium corresponding to the corpuscles in the hemolytic system and in both instances known as antigen, (2) a bacteriolytic amboceptor corresponding to the hemolytic amboceptor, and (3) complement similar in both systems. If the component parts of the bacteriolytic system are placed together in a test tube at 37° C., union will take place just as in the hemolytic system, and the antigen or bacterium will be dissolved. The union of the three substances in the bacteriolytic system, however, is not visible to the naked eye. It can not be proved, from the appearance of the tubes, whether or not the bacteria have been dissolved. The solution of the sheep's red blood corpuscles, on the other hand, was most apparent, the mixture changing from an opaque to a clear-red color upon hemolysis. In the hemolytic system, therefore, there was an indicator to show that solution of the corpuscles had taken place, whereas no indicator was present in the bacteriolytic system.

The reaction discovered by Bordet and Gengou in 1901 utilizes the phenomenon of hemolysis to show that a union actually can occur between the three components of a bacteriolytic system. This reaction depends upon the principle of complement fixation and is performed as follows: The three elements composing the bacteriolytic system such as typhoid bacilli (bacteriolytic antigen) plus the inactivated serum of the patient to be tested for typhoid antibodies plus complement (fresh guinea pig serum) in just enough quantity to complete the union are placed in a test tube and incubated for one-half hour at 37° C. to allow them to unite. To the same tube are then added hemolytic amboceptor (immunized rabbit serum inactivated) and suspension of sheep's blood corpuscles from the hemolytic system, but no more complement. The mixture is again placed in the incubator at 37° C. It will be noticed that there is present just enough complement to complete the union of one system, but not both.

Therefore, if union has taken place in the bacteriolytic system, showing that the patient's serum contained typhoid antibodies or amboceptor, the complement will be used up (fixed or deviated) and, there being none left to unite with the two parts of the hemolytic system, no hemolysis will occur and the solution will remain opaque. If, on the other hand, no union of the first three substances has occurred because the patient's serum contained no typhoid antibodies, the complement not being fixed will be available to unite with the two parts of the hemolytic system, and the sheep's blood corpuscles will go into solution, as will be shown by the solution becoming a clear-red color.

The absence of hemolysis, therefore, denotes a positive reaction, and the occurrence of hemolysis denotes a negative one.

In 1906 Wassermann applied this principle of complement fixation in the diagnosis of syphilis. As it was impossible to obtain a culture of the Spirocheta pallida as antigen, Wassermann employed an extract of syphilitic tissue known to contain the organism in large numbers. The same principles as just described were then applied to syphilis, the extract of syphilitic tissue being substituted for the emulsion of typhoid bacilli and the serum of the patient to be tested for syphilis for the serum of the patient to be tested for typhoid.

It has since been demonstrated that other substances besides the extract of syphilitic tissue which are in no way related to syphilis, such as lecithin, various lipoid substances and salts, could be used equally well as antigen. While this proves that the reaction is not a true antigen antibody reaction as Wassermann originally believed, it does not in any way destroy the practical value of the test.

The five following substances are used in performing the Wassermann reaction:

1. **Antigen.**—The antigen originally recommended by Wassermann was made by macerating the liver of a syphilitic fetus in 0.85 per cent salt solution containing 0.5 per cent phenol. The proportion used was 4 parts of fluid to 1 of tissue.

| | |
|---|---|
| 360 c.c. | salt solution (0.85 per cent). |
| 100 | grams liver. |
| 40 c.c. | phenol (5 per cent). |

This mixture is thoroughly shaken for twenty-four hours in a shaking machine. The fluid is then decanted off and kept in the ice box in a dark, well-stoppered bottle. Most workers are agreed that watery extracts are likely to become anticomplementary by themselves on standing, or may lose their power to react with luetic sera. Marie, Levaditi, and also Bruck use the watery extract in a dried powdered form. It is evaporated in vacuum and kept in sealed tubes. Bruck dissolves 1 gram of the dry extract in 1 c.c. of distilled water before use. The amount of watery extract used in the test is 0.1 to 0.2 c.c.

As stated before, Wassermann originally believed that the antigen was specific, but many investigators have since proved that alcoholic extracts of certain normal organs rich in lecithin, preparations of crude lecithin, and certain lipoid substances act equally as well as antigen, and they are now generally used for the reaction.

It is necessary not only that an antigen should deviate complement in the presence of a syphilitic serum, but also that it should give a minimum deviation with nonsyphilitic serum.

The unit dose of antigen must be of such strength that one unit will completely inhibit hemolysis of 1 c.c. of a 5 per cent suspension of sheep's red blood corpuscles with 0.2 c.c. of known luetic serum plus 0.1 c.c. of fresh guinea pig complement; provided double this dose does not interfere with complete hemolysis of sheep's erythrocytes when 0.2 c.c. of known normal serum is used plus 0.1 c.c. of fresh guinea pig complement. From the above facts it is evident that the dose next to the largest hemolyzing dose is the strength of one unit, or 0.1 c.c. It ise also apparent that 0.2 c.c., or a double dose, will not inhibit hemolysis when used with normal serum. A dose of antigen, therefore, should be used which does not bind complement even when twice the quantity of antigen is used.

2. **Amboceptor or Immune Body.**—Antisheep amboceptor is generally used. For its preparation a number of healthy rabbits are injected intraperitoneally every fourth or fifth day with increasing doses of washed sheep's blood corpuscles. The sheep's blood is obtained from a slaughter-house, and is immediately defibrinated. The corpuscles are then washed thoroughly with a high-power centrifuge. After the first centrifugalization the clear serum is pipetted off and 0.95 per cent salt solution is added and the process is repeated. After several washings, when the serum has been entirely removed, the original volume is replaced by isotonic salt solution; 2 c.c. of this fluid are used for the first injection of the rabbit. The second dose is increased to 4 c.c. of cells washed as previously described and brought to its original volume, and so on until four or five injections have been given. Nine or ten days after the last injection the rabbit is bled and the serum is allowed to separate. The serum when collected should be kept in a cold place. One unit of amboceptor should be determined by titrating against 1 c.c. of a 5 per cent suspension of washed sheep's

corpuscles, using 0.1 c.c. of guinea pig complement. Two units are used in the test.

3. **Complement.**—This is obtained by bleeding a full-grown guinea pig in a large, sterile Petri dish. The blood should be allowed to stand at room temperature for two or three hours, when the serum may be pipetted off; 0.1 c.c. of guinea pig complement is the amount used in the test. The serum should not be more than two days old, and it should be kept in the ice box when not in use.

4. **Sheep's Red Blood Corpuscle Suspension.**—One c.c. of 5 per cent suspension of washed sheep's corpuscles is used in making the reaction. The blood should not be more than a few days old, and should be kept on ice. To make the suspension 1 c.c. of the sheep's blood corpuscles, after being washed three times with 0.95 per cent salt solution, is mixed with 20 c.c. of salt solution, making a 5 per cent suspension of cells.

5. **Serum of the Patient to be Tested.**—Blood is drawn from a vein into a sterile receptacle and allowed to clot. The serum which is collected after clotting is inactivated by heating to 55° C. for one-half hour just before use. It is better to use the serum not later than twenty-four hours after collection, although it may be used forty-eight hours after if kept in the ice box. In drawing the blood at least 5 c.c. should be obtained and preferably 10; 0.2 c.c. of inactivated serum is used in performing the test. The cerebrospinal fluid may also be used for making the test. When used, twice the quantity should be employed, and it should not be heated to 55° C., as it contains no hemolytic complement. It should also be free from blood.

## TECHNIC OF THE WASSERMANN REACTION

Take six clean test tubes and place them in the rack in pairs, three in a row, one behind the other. In the first pair of tubes put 0.2 c.c. of inactivated serum from a known syphilitic, in each of the second pair of tubes 0.2 c.c. of the inactivated serum of the patient's blood to be tested, and in each of the third pair of tubes 0.2 c.c. of inactivated serum of a known normal blood.

The first and third tubes are used as controls.

Now to all the tubes is added 0.1 c.c. of fresh guinea pig complement; 1 unit of antigen is next added to the first row of tubes only (one of each of the three pairs of tubes). The antigen is omitted from the back row of tubes to make sure that hemolysis will not be inhibited without the presence of antigen. Finally, all the tubes receive 3 c.c. of salt solution. The tubes are then shaken and incubated at 37° C.

for one hour to allow the ingredients to unite. They are then removed and 2 units of amboceptor and 1 c.c. of the suspension of sheep's red blood corpuscles are added to all the tubes, and they are again incubated for two hours, when they should be removed and placed in an ice box for twenty hours. The test is now complete and the reaction may be read. Complete hemolysis should have occurred in all of the rear tubes and also in the front tube of the normal serum. Complete inhibition of hemolysis should have occurred in the front tube containing the known syphilitic serum. If the front tube containing the serum of the patient's blood to be tested has completely hemolyzed, the reaction is negative. On the other hand, if complete inhibition of hemolysis is shown in this tube, the reaction is positive. It is apparent, therefore, that inhibition of hemolysis means a positive reaction, which, according to its degree of intensity, may be classed as strong positive, positive, or weak positive. Complete hemolysis means a negative reaction.

The Wassermann reaction is complicated and requires not only a great deal of training for the perfection of the technic but a considerable expenditure of time for its performance. It is practically impossible unless one has access to a well-equipped biological laboratory. Many attempts have been made to simplify the reaction, but serologists are of the opinion at the present time that the only method which can be depended upon for a correct result is the old, or long, method described above. Even the modification originated by Doctor Hideyo Noguchi of the Rockefeller Institution of New York has fallen into disfavor and is now seldom used.

## CLINICAL APPLICATION OF THE WASSERMANN REACTION

The diagnostic value of the Wassermann test depends upon the fact that the antibody contained in the serum causing the reaction is specific, occurring only in the serum of luetics. Except in rare instances this has been found to be true. Positive reactions have been obtained in frambesia, relapsing fever, trypanosome infections, and tubercular leprosy. It is also found positive after veronal, morphine, scopolamine, ether narcosis (Wolfsohn), and frequently in sera obtained just before or after death. Therefore, while it is true that a positive reaction is obtained in a few diseases and conditions other than syphilis, the differential diagnosis between syphilis and those diseases should not be difficult, at least in this country, and the reaction may be said to be practically specific. A negative reaction, on the other hand, can not be accepted as proof that the disease does not exist, as negative findings have been obtained in a small percentage of active cases of syphilis. If, however, a negative reaction is repeatedly obtained after several trials made at intervals, it is almost positive proof that the disease is not present. The reaction appears from two to four weeks after the appearance of the initial lesion, and persists throughout all stages of the disease unless influenced by treatment. A positive reaction has been obtained forty or fifty years after infection. Quite often a positive reaction may be obtained before the appearance of secondary symptoms. In the active stages of the disease 95 per cent of cases give a positive Wassermann reaction and at least 75 per cent of tertiary cases. In latent cases of the disease, while the continued existence of the spirochetæ renders the patients liable to outbreaks of symptoms at any time, nevertheless, the organism is often in a dormant state, which makes the appearance of symptoms less likely. In these latent cases a positive reaction is obtained in 50 per cent of the cases. It is in this class of cases that the Wassermann reaction is of special value as these patients are often apparently healthy and may give no history of ever having had the disease. Oftentimes a negative reaction in these latent cases may be transformed into a positive reaction by the administration of a short course of mercury or salvarsan.

## DIAGNOSTIC VALUE OF THE SERUM REACTION

From our present knowledge it is evident that a positive Wassermann reaction is of inestimable value in differentiating atypical lesions of all stages of lues. Indefinite symptoms not suspected of being syphilitic have been proved to have been so by the positive Wassermann reaction and the subsequent cure under antisyphilitic treatment. The Wassermann reaction, unlike the therapeutic test, enables us to establish the nature of the condition directly and not by inference. It has proved also that primary sores may show all gradations from the typical indurated chancre to a slight abrasion.

The law of Colles, that the mother of a syphilitic child is immune to the disease, and also that of Profeta, according to which the child of a syphilitic mother is immune to syphilis, have both been dsproved by the Wassermann reaction. A positive Wassermann reaction is often obtained in children with none of the characteristic inherited stigmata of syphilis, and showing almost no symptoms except perhaps anemia and nervousness.

Nearly 90 per cent of tabetic patients give a positive reaction. In dementia paralytica the reaction is always positive, and in congenital syphilis the reaction is generally stronger than in other forms. In cases of aneurism of the aorta and in the earlier history of arteriosclerosis and aortic insufficiency the reaction is generally positive. While a positive reaction is absolute proof that living spirochetæ are present in the patient's body, a negative reaction, even though there is no fault in the technic in performing the test, does not definitely exclude syphilis. It is quite certain, however, that repeated negative reactions will not be obtained if active syphilis is present.

In the primary stage of the disease the Wassermann reaction should be supplementary to the demonstration of the spirochetæ by the microscope as a method of diagnosis. In the differential diagnosis of tertiary lesions and latent lues it must be remembered that, while a positive reaction always means the presence of syphilis, it does not necessarily follow that the lesion in question is syphilitic. For example, it is quite a frequent occurrence to have an epithelioma develop on a gumma of the tongue, in which case a positive reaction would show that the patient had syphilis, but a histologic examination would be necessary to establish the diagnosis of epithelioma.

No matter at what period of the disease a positive reaction is obtained, it is evidence that the disease is active or at least that there exist living spirochetæ, and that the patient is in need of further treatment to prevent the occurrence of symptoms or relapses. In the event of a positive reaction appearing persistently in spite of energetic treatment, the prognosis is bad and these cases generally terminate in dementia paralytica.

## EFFECT OF TREATMENT ON THE REACTION

In the early studies of the serum reaction it was noted that cases which had received treatment gave a much lower percentage of positive reactions than untreated cases. Citron, who was the first to make this observation, after a careful study of his results, propounded the two following laws: 1. The longer the syphilitic virus has worked in the body and the oftener it has caused recurrences, the more constant and stronger is the antibody content of the serum. 2. The earlier the mercurial treatment is started, the longer it is continued, the more frequently it is repeated, the more efficient the method of application, the less is the antibody content and the more frequently the reaction is negative.

The general result of treatment, according to Citron, is that energetic mercurialization begun as early as possible after infection and long continued restores the serum to its normal condition. The greater the length of time allowed to elapse without treatment after inoculation, the more difficult it is to restore the serum to normal. While a positive reaction may become negative after several months of active treatment, this is not an indication that treatment may be discontinued, but simply that the disease is under control and responding to treatment. If, on the other hand, the reaction remains positive in spite of the treatment, it is an indication that the treatment is not efficient and the method of its application should be changed or it should be supplemented by other remedies. Latent cases of syphilis showing no manifest symptoms, but giving a positive Wassermann reaction, should receive further treatment, as they are in danger at any time of relapses.

The Wassermann reaction is the surest test at our disposal as to whether a patient after a thorough course of treatment is cured, and it should be used to control the treatment of all cases of syphilis. Cases under treatment should be examined every three or four months. After several years' treatment, if the reaction is positive, treatment should be continued. If negative, treatment may be discontinued and the patient's blood examined every four to six months and finally every year. Treatment should be resumed immediately upon the reappearance of a positive reaction.

## EFFECT OF SALVARSAN ON THE WASSERMANN REACTION

The effect of salvarsan on the serum reaction, as reported by many different observers, differs widely. The reaction does not always change from positive to negative, and the time of such change when it does occur varies within very wide limits. My experience has been to note a change from a positive to a negative reaction on an average of four weeks after injection of the drug. Most of the cases which I have been able to follow up which have received no treatment after the one injection of salvarsan have had a return of the positive reaction in from three to five months. One case of chancre of the lip, treated before the appearance of any of the secondary symptoms, has remained negative without further treatment for over a year. On the other hand, a case of syphilitic glossitis of eight years' standing, which had been receiving treatment continually all that time with little effect, was cured clinically three weeks after one injection of salvarsan, but has never yet had a negative Wassermann reaction seventeen months after the injection.

The experience of most observers in regard to the effect of salvarsan on the Wassermann reaction is similar. In some cases there are decided changes; in equally as many others they are doubtful or absent. It is claimed by some observers that, since larger doses are being used, changes from positive to negative are more frequent and appear earlier. Certainly the effect of salvarsan upon the Wassermann reaction is much less favorable than upon the clinical manifestations of syphilis.

These earlier experiences with salvarsan have taught that it is necessary to give a number of intravenous injections of salvarsan and follow it with an intensive mercurial treatment.

Since this method of using salvarsan in repeated doses, followed by active mercurial treatment, the percentage of negative Wassermanns which did not relapse, but remained so, has become much higher than under the earlier method of treatment.

The chance of obtaining a negative Wassermann after one course of intensive treatment consisting of from four to six intravenous injections of salvarsan and a dozen intramuscular injections of mercury or twenty or thirty inunctions, is much greater if treatment is begun in the primary stage of syphilis.

In the presence of syphilis of some years' standing it requires several courses of treatment with salvarsan and mercury to get a negative Wassermann, and the negative phase is more apt to become positive again if treatment is discontinued in these old cases.

# CHAPTER LI

## PROGNOSIS OF SYPHILIS

The danger to life, in syphilis in the adult, depends upon the involvement of some vital organ such as the heart or aorta by endarteritis or gummatous infiltration or the development of tabes or general paresis, and these remote results most frequently occur years after infection; but as already stated, individuals in whom the treatment is begun early and carried out systematically and intelligently according to the modern requirements, for a sufficient length of time, rarely develop tertiary symptoms.

It is, however, impossible to tell the patient at the beginning of the disease whether it will run a mild or a severe course. At the present time since the discovery of the Wassermann and the use of salvarsan for treatment, the prognosis is better than formerly, since now we can observe our patients by means of the Wassermann test and if a latent syphilis is discovered, a sufficient amount of treatment may be given in order to eradicate the disease before irremediable damage is done to vital organs.

If all syphilitics are kept under observation until the Wassermann becomes permanently negative, the occurrence of tabes, paresis, or other late tertiary manifestations may be entirely prevented, for the presence of a positive Wassermann reaction after a certain amount of treatment has been given is an ominous danger signal which may not be disregarded.

In women, the treatment should be carried out to the same extent to prevent the dangers not only to themselves, but that of bringing syphilitic children into the world.

One negative Wassermann is not to be depended upon, because it is known that soon after treatment the Wassermann can become negative and later become positive again.

For this reason a negative Wassermann early in the disease has but little meaning, whereas late in the disease, after the cessation of all treatment, a negative Wassermann is of more value.

In general the Wassermann reaction becomes permanently negative after two or three years, but in certain cases the Wassermann still remains positive after many years.

It is safer for the patient if visible manifestations are present on the skin or mucous membranes, for in such cases they will attract attention and cause him to seek treatment; but if the lesions are not visible and a positive Wassermann is the only sign of aortitis, or other active changes in the viscera or nervous system, they may without warning cause a disturbance which may be fatal.

The ultimate recovery of the patient depends upon the following factors:

1. *The time after the appearance of the initial lesion at which intensive treatment is instituted.*

In the early days of the infection, the spirochetæ are comparatively few in number and have but a light hold upon the tissues of the body. If treatment with salvarsan and mercury is begun in the primary stage, there is a fair possibility of aborting the disease with one course of treatment. If the treatment is not employed until the secondary stage, several courses of treatment will have to be used before getting a permanently negative Wassermann, signifying a cure.

If the patient is allowed to go on to the tertiary stage with insufficient or no treatment, it is much more difficult to destroy all the spirocheta in the body and will require more courses of treatment and a longer period of time to accomplish their destruction.

2. *The systematic thoroughness and length of time which the case is treated.*

Leredde estimated that in Paris in 1910 out of 10,821 deaths from all causes, circulatory and nervous diseases due to syphilis caused 3,374, or a little more than 31 per cent.

The effects of treatment in preventing tertiary accidents are shown by Fournier who found out of 2,396 cases who had taken treatment for at least three years only 3 per cent developed tertiary complications.

Jadassohn found 4.6 per cent of tertiary lesions developing among patients properly treated and in the Breslau Clinic, Peols noted out of 6,203 syphilitics treated that only one per cent had tertiary manifestations.

Marschalko, in a study of 673 cases, states that as a result of proper treatment tertiary lesions occurred in only 2.7 per cent; in imperfectly treated cases they occurred in 19.3 per cent, and under insufficient treatment they developed in 23.9 per cent.

The next factor of prognostic value is:

3. *The constitution of the patient.*

Any causes which tend to depress the general health—such as privation, bad hygienic surroundings, overwork, anxiety, loss of sleep, and particularly habits of alcoholic indulgence and pulmonary phthisis—are very unfavorable influences.

As in most other diseases, the extremes of life, that is, old persons and very young children, bear syphilis badly, and the death rate among children with inherited syphilis is high. Syphilis acquired, however, after birth, in the early years of childhood, runs a milder course than with adults. Women are believed to be less severely affected than men, and are thought to be less liable to syphilitic affections of the nervous system.

The appearance of tertiary lesions prematurely, i.e., in the early months of the disease, is a very unfavorable prognostic sign.

*Extragenital* chancres—i.e., those which are located on the finger, breast, lip, etc.—are more apt to be followed by a severe attack of syphilis than in cases where the chancre is located upon the genitals.

The last factor, or:

4. *The virulence of the poison,* is a very uncertain quantity, although the question of different stains of the spirocheta which has now been well demonstrated no doubt has a good deal to do with the severity of the disease in certain people.

The question of relative immunity is too uncertain yet to draw definite conclusions, but it is a fact often observed in former years and generations that syphilis in certain epidemics was particularly severe in its course, and fatal in its results. This was noted when syphilis was first observed in Europe, in the sixteenth century, and also in the Sandwich Islands, when syphilis was first introduced among the natives.

It is thought today, by many syphilographers, that the disease is assuming a milder type than in past years.

These facts have been accounted for by various theories: it is supposed that a certain amount of inherited immunity exists among European nations, which mitigates the course of the acquired disease, while when syphilis is introduced for the first time among a new people there is no inherited immunity among them to protect them from its force.

## TEST AS TO CURE OF SYPHILIS

The conditions necessary to be complied with in order to state that syphilis is cured in an individual have been formulated by Wechselmann (Salvarsan Therapy, ii., p. 110) and are now generally accepted.

An individual infected with syphilis is cured if he is free from symptoms of the skin, mucous membranes, and all the inner organs, when his blood serum no longer shows the Wassermann reaction, when his lumbar puncture shows no alterations, and if this absence of all positive signs, especially the last two most important symptoms (i.e., negative Wassermann and negative lumbar puncture) remains permanent upon most careful control for a certain period of time. This period of time is now generally accepted as one year, although this is not absolute.

In order to control the case properly the Wassermann reaction of the blood should be taken at intervals of from two to four months, and a spinal puncture should be made at less frequent intervals.

## SYPHILIS AND MARRIAGE

The rules formerly laid down with regard to the marriage of individuals who have had syphilis can no longer be adhered to since the discovery of the exact tests which show the presence of a latent syphilis even though no symptoms are present. For individuals contemplating matrimony the foregoing test of cure should be made, and if the patient conforms to it, it is perfectly safe for him to marry without fear of begetting syphilitic infants or infecting his wife.

The time after infection at which these conditions may be attained varies in each individual case and no definite rule in that respect can be laid down.

Marriage, however, should not be sanctioned in the presence of a positive Wassermann in the person of either of the contracting parties.

There are certain of the old clinical observations which are still in force today and which afford useful working guides for practice. They may be briefly stated as follows:

1. A man or woman having had syphilis should not be permitted to marry until he or she, after treatment for a sufficient length of time, shall have been clinically and serologically free from symptoms for at least one year.

2. If a married man or woman acquire syphilis, sexual intercourse should be interdicted on account of the danger of infecting the healthy party.

3. A pregnant woman with syphilis should be energetically treated during the entire period of pregnancy with the hope of curing or mitigating the severity of the infection of the child *in utero.*

4. If a woman free from syphilis becomes pregnant by a syphilitic man, she should be frequently examined clinically and serologically, to detect a latent syphilis without visible manifestation; and if syphilis should develop, she should be energetically treated.

5. A syphilitic child should only nurse from its mother, and never be allowed to nurse from a wet-nurse on account of the danger of infecting her.

# CHAPTER LII

## TREATMENT OF SYPHILIS

As syphilis is a general and constitutional disease, dependent upon a specific poison, the Spirocheta pallida, it is necessary to introduce a remedy into the circulation which will neutralize it and render it inert and harmless.

In the light of our present day knowledge, the spirochetæ are more quickly and certainly destroyed by the intravenous injection of salvarsan followed or accompanied by the hypodermic or endermic use of mercury than by any other form of treatment.

### SALVARSAN

The discovery of salvarsan by Ehrlich marks an epoch in the treatment of syphilis, and, while unfortunately the hope of destroying the disease at one blow by one or even two injections of salvarsan has not been realized in the human subject, we have now a second therapeutic resource which is equal and in some cases superior to mercury.

While in human beings a dose of salvarsan will not destroy all the spirochetæ, it has been experimentally found that in animals artificially inoculated with syphilis it is possible to destroy all of the disease excitants with one dose of salvarsan, thus accomplishing the sterilizatio magna hoped for by Ehrlich, but in the human being a dose sufficiently large in proportion to the body weight to accomplish this can not be given without causing poisoning.

Salvarsan was discovered by Ehrlich after 605 experiments with various substances; hence the name "Ehrlich-Hata 606," by which it was originally known when first placed upon the market in December, 1910.

Salvarsan is an organic chemical compound containing 3 atoms of arsenic, and chemically known as dioxydiamidoarsenobenzol. It is put upon the market in sealed ampules containing 0.6 gram of the salt.

In form it is a yellow powder, of an acid reaction, easily soluble in water, and after a couple of hours' exposure to the air oxidizing readily, which changes its color and increases its toxic properties, thus making it necessary always to use it in a freshly made solution.

The effects of salvarsan upon the organism may be studied under three heads:

1. As an antiparasitic, destroying the spirochetæ. The destruction of the spirillæ takes place very rapidly, and a few hours after the injection they can no longer be found in the primary lesion or in papules.

2. As affecting all the tissues of the body and increasing the nutrition, which is a notable feature of the treatment.

**Clinical Effects of Salvarsan.**—After an injection of salvarsan, the spirochetæ disappear from the primary lesion in from eight to forty-eight hours, and the chancre is often healed in a week.

Mucous patches, condylomata, and secondary periostitis and iritis disappear frequently in two or three days, which is vastly more rapid than when treated by mercury.

Syphilitic roseola fades quickly, but the large and small papular syphilides as well as palmar syphilides are more resistant and heal with relative slowness.

Tertiary lesions, such as gummata in the skin and bones, disappear quickly.

In malignant syphilis the effects of salvarsan are brilliant, especially in the cases which are refractory to mercury and iodides, for this type of disease is characterized by its nontolerance of ordinary antisyphilitic remedies.

The effects of salvarsan on tabes and paresis have also been sufficiently studied to give a fair estimate of its value. In these conditions it is logical to suppose that nothing can bring about a restitution after the nerve cells have been destroyed by the pressure of the newly formed connective tissue. Salvarsan will not cure such degenerations. Under its use, however, the symptoms are improved and the lancinating pains and Romberg's symptoms are relieved for the time. The improvement is only temporary and the courses of salvarsan and mercury must be repeated. In these patients the intraspinal injection of salvarsanized serum seems to offer the best hope of arresting the progress of the disease, and iodide of potash has here a field of therapeutic usefulness.

Congenital syphilis has been a most fatal disease in the past, but since the use of salvarsan the mortality has been materially diminished.

**Mode of Administration.**—As salvarsan has been known to cause deafness and disturbances of the nervous system, which always yield to mercury if given afterward, in certain cases of nervous disease, it has been recommended to preface the treatment with salvarsan by a few injections or inunctions of mercury with a view of preventing the Herxheimer reaction and so avoiding serious consequences.

*The subcutaneous use of salvarsan* is now entirely abandoned, for after injections it remains in the subcutaneous tissues without being absorbed and also causes, in nearly every case, a severe necrosis of the tissues, with sloughing and loss of substance.

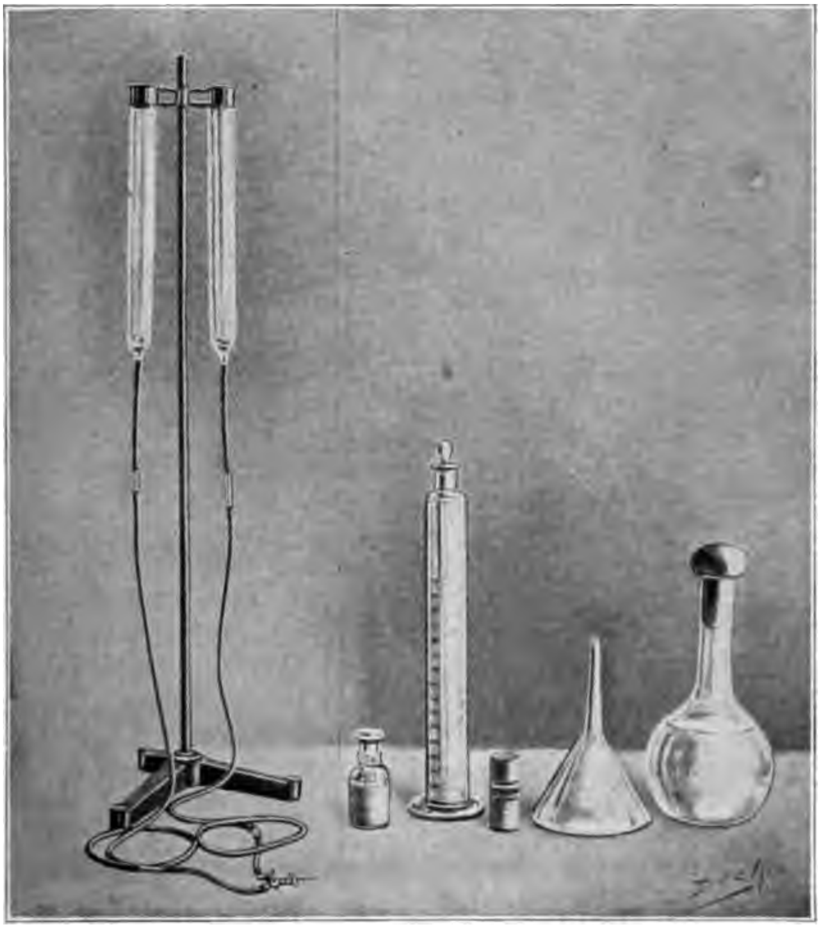

Fig. 330.—Assmy's apparatus for intravenous injection of salvarsan.

In the Charité 20 subcutaneous injections were made with 25 per cent of abscess formation.

In the Long Island College Hospital we gave 2 patients salvarsan subcutaneously, and in neither case was the dose absorbed. It had no influence on the lesions and remained for weeks as a hard infiltration under the skin.

Absorption of these deposits into the blood occurs but slightly if at all, so that there is no sterilizing effect exerted upon the spirocheta in the blood and tissues.

The use of intramuscular injections is always accompanied by intense and persistent pains which they cause and an infiltration that lasts a long time. These infiltrations appear as an abscess forming, and the tissues over them break down and slough, leaving large cavities.

The same holds true in regard to neosalvarsan injected into the tissues and its use in this way must be strongly condemned. As the matter stands today, the strong feeling among syphilographers is that the intravenous injection of salvarsan is the only method that deserves serious consideration and the practitioner who temporizes and tries to use some very inferior substitute for the now universally accepted practice, places his patient's future in jeopardy.

The relation between the development of cardiac and nervous disease and insufficient treatment has been described, and the practitioner who attempts to treat a case of syphilis with intramuscular injections of neosalvarsan is guilty of malpractice in the light of our present knowledge.

**Intravenous Injections of Salvarsan.**—The most convenient form of apparatus is the one devised by Assmy, and consists of two containers, one for salvarsan and the other for salt solution.

The contents of an ampule containing 0.06 gram is put into the mixture containing 40 or 50 glass beads, normal salt solution made with freshly distilled water and sterilized in the autoclave, is added and the vessel shaken until the salvarsan is completely dissolved; 23 drops of sodium hydroxide solution are added to render the solution alkaline.

The solution is poured into one container and enough salt solution added to make 150 c.c., and the second container is filled with salt solution. All the solutions must be warm and made with freshly distilled water which has been boiled or sterilized in the autoclave.

Wechselmann has noted that the use of freshly made salt solution was not followed by marked reaction but that a reaction always followed the use of salt solution which was old, and he accounts for it by supposing that old solutions contain albuminous products as a result of the destruction by boiling of the organisms contained in the water.

In consequence, he always filters and boils his salt solution shortly before using, and has had less trouble from severe reactions since adopting this practice.

After sterilization of the skin with green soap, alcohol, and ether or iodine, a towel tourniquet is placed around the upper arm. The cannula is then thrust into one of the swollen veins at the bend of the elbow. That the cannula is lying within the vein is demonstrated by the flow of blood through it. Salt solution is allowed to flow through the cannula first, to make sure that the vein has not been wounded, and if no infiltration into the subcutaneous tissues occurs the salt solution is turned off and the salvarsan allowed to flow in; 150 c.c. of the solution should take from eight to ten minutes to enter the vein.

After the salvarsan container is emptied, 10 to 20 c.c. of salt solution are allowed to flow in to carry in the rest of the salvarsan, and the needle withdrawn and the puncture dressed with gauze and adhesive plaster.

When salvarsan first began to be used, it was thought necessary to keep the patient in bed for twenty-four hours after each injection. This is now found to be quite unnecessary except in cardiac cases or other exceptional conditions, and today the patients receive their injection in a clinic or surgeon's office and go home immediately afterwards without running any risk of severe reaction.

### Reactions Following Salvarsan

1. **Nitroid Crises.**[1]—It is not uncommon to note during the administration of the drug, flushing of the face, dyspnea, precordial distress and headache. The symptoms are a manifestation of anaphylaxis and can be prevented by the administration of 20 minims adrenalin solution 1:1000 previous to beginning the injection of salvarsan.

2. **Arsenical Poisoning.**—The symptoms of this condition occur within a few hours of the administration of the salvarsan and consist in chill, rise of temperature, and vomiting. The urine is scanty and contains blood and albumin.

Patients with these symptoms usually recover, but sometimes the poisoning is so intense that death ensues.

The "Water error" of Wechselmann will probably account for the acute arsenical poisoning in these cases. He found that the injection of alkaline solutions of salvarsan in water *freshly* distilled was followed by surprisingly little reaction, and attributed this difference in the action of water freshly distilled as compared with *water that had been distilled some time previously, but recently sterilized by boiling,* *to the fact that spores of nonpathogenic microorganisms in such water develop between the time of distillation and that of boiling and though killed by the boiling, leave an albuminous element (their corpses) in the water which unites with the salvarsan to cause a disintegration of this into less highly organized compounds of arsenic, to which the toxic effects of the drug are attributable.* Wechselmann's theory has been supported by many independent observations, notably those of McIntosh, Fildes, and Dearden, and it is without question that the use of freshly distilled water largely prevents strong reaction following salvarsan.

3. **Salvarsan Serous Apoplexy of Milian.**[2]—After the injection of salvarsan the patient falls into coma on the third day, often without premonitory symptoms, and dies within a few hours.

Autopsy shows no organic change in the brain, but only edema and congestion. Milian describes this as a "nitroid crisis of the brain" and states that adrenalin in doses of 1 to 5 mg. induces such intense vasoconstriction that the serous apoplexy is arrested.

4. **Herxheimer Reaction.**[3]—The condition described above may be a manifestation of the Herxheimer reaction which is explained by a sudden killing of the spirochetæ with consequent loosening of their toxins and resultant edema and swelling of the parts affected.

Through the swelling and consequent pressure if applied to uncompressible tissues, such as the brain, a fatal result may follow, or if the swelling occurs around a nerve running through a bony canal, the pressure may cause pain or loss of function resulting in deafness, dizziness, or even loss of consciousness.

The congestion, swelling, and edema may occur on the skin and is visible as a deepening and darkening of color of the existing macules and a development of macules or papules which were previously not visible; sometimes a red zone of a darker color is noticed around existing papules or a fresh maculopapular eruption or dermatitis, accompanied by fever resembling measles may appear.

It disappears in a few days leaving a slight desquamation.

If a dermatitis follows the use of salvarsan, the drug should not be repeated for at least six months. Cases of death have followed the administration of salvarsan where such a warning was disregarded.

5. **Neurorecidives.**—This phenomenon occurs several weeks or months after the administration of salvarsan and consists in a reactivation of an old and latent process in a nerve or of the development of an entirely new lesion.

These processes are due to the spirocheta, but appear to follow as a direct sequence the administration of salvarsan.

The involvement of the auditory[4] nerve may be an example of a neurorecidive. Benario found involvement of this nerve 62 times in 14,000 cases treated by salvarsan. The deafness was only temporary and subsided after continuing the treatment of the syphilis.

## Accidents

With a correct technic serious accidents should not occur, but with one which is faulty the patient's life may be seriously endangered. An accident which may be guarded against by the preliminary infusion of salt solution is a wound of the vein and subsequent leakage of salvarsan into the cellular tissue. If the vein is wounded and salt solution leaks out, the swelling is at once perceived around the vein and no harm is done, but if salvarsan leaks into the tissues it causes intense pain, inflammatory swelling, and sometimes extensive sloughing.

A thrombus which is dislodged and carried into the general circulation may occur from a solution which is too strongly alkaline or from a wound of the vein.

Carrying air into the vein from the apparatus may be guarded against by raising the rubber tubes with the stopcock open, allowing the air to escape into the container. This precaution should never be omitted; otherwise, air-bubbles will be carried into the circulation, interfering with closure of the cardiac valves, and possibly causing sudden death.

With due regard to the above-described conditions it is possible to say that, with proper application and healthy organs, there is no danger to life.

The conditions in which it is dangerous to use salvarsan are aneurism and dilatation of the heart, in recent cases of myocarditis and valvular disease, when good compensation does not exist—for fear of the high temperature following the injection causing a collapse.

In brain syphilis it must be used with extreme caution; as already noted, marked diabetes, nephritis not of a syphilitic origin, advanced tuberculosis, and extreme age are all contraindications to its use.

When salvarsan was first used it was feared that it might have a deleterious effect on syphilitic diseases of the eye. That fear has proved to be without foundation. In acute optic neuritis, choroiditis and interstitial keratitis in congenital syphilis, salvarsan clears up the lesions with great rapidity.

In optic atrophy salvarsan has been given with apparent benefit, but was not followed by the brilliant results of the other conditions.

## Elimination of Salvarsan

Investigations as to the elimination of salvarsan show that in four or five days it is eliminated from the blood, but that deposits of the drug are found in the glandular organs.

Jeanselme[5] estimated the amounts of salvarsan in various organs of three patients who died of intercurrent causes at various intervals after salvarsan treatment. In two treated respectively a week and nine months before death, the spleen contained the largest amount of salvarsan. From these and the observations of others, he concludes that *in different cases the arsenic may become fixed by preference in the spleen, liver, nervous system, or lungs, without there being any apparent reason for such selective localization. Where the function of the kidneys fails, however, the arsenic seems to accumulate there.*

## Special Indications for Salvarsan

Salvarsan is indicated in practically every case of syphilis, and the earlier its use is begun in the disease, the more likelihood exists of being able to get a cure with the minimum amount of treatment, and it is urgently called for in the presence of mucous patches and condylomata in secondary syphilis to cause them to heal rapidly and so remove the danger of infection for other people.

In late syphilis when the integrity of a vital organ is threatened, salvarsan is strongly indicated; and in the presence of latent syphilis with a positive Wassermann it should be used to prevent involvement of the viscera or nervous system.

The indications for its use may be formulated as follows:

1. As an abortive treatment combined with excision of the chancre when possible, and followed by an energetic course of mercurial treatment.
2. All cases of syphilis with manifest symptoms.
3. Latent syphilis with a positive Wassermann reaction.
4. Cases of tabes and general paralysis.
5. In cases where there is an idiosyncrasy against mercury and patients are too easily salivated.
6. Where mercury has had but little effect in healing lesions or when relapses take place rapidly after using.

7. In cases when after considerable mercurial treatment the Wassermann reaction still remains positive.
8. Malignant syphilis.
9. Gummata of vital organs.
10. Painful periostitis.
11. Congenital syphilis.

### Comparison between Salvarsan and Neosalvarsan

The general feeling among syphilographers in America is that, while neosalvarsan is more convenient to administer on account of being soluble in a smaller quantity of water and not requiring the addition of sodium hydrate to neutralize the solution, it is not as efficient in its action in the cure of syphilis as old salvarsan.

The experiments of Nelson and Haines[6] demonstrated that 64 per cent of patients treated with old salvarsan and mercury showed a negative Wassermann, while only 33 per cent of patients treated with neosalvarsan and mercury became negative. They considered that if neosalvarsan be used at all, it should be used in the proportion of six or eight of neosalvarsan to two of old salvarsan.

Whitehouse and Clarke[7] obtained 20 per cent more negative Wassermanns with old salvarsan serologically than with the neosalvarsan.

Schamberg states that from clinical observations and also with experiments on trypansomiasis he believes that salvarsan is distinctly superior to neosalvarsan.

Trimble and Rothwell,[8] however, report a larger percentage of negative reactions with neosalvarsan than with old salvarsan.*

## MERCURY

Before the introduction of salvarsan, mercury was the mainstay in the treatment of syphilis, and today the best results are obtained by a combination of the two remedies.

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*At the present time the supply of salvarsan made in Germany is no longer obtainable. The Council on Pharmacy of the American Medical Association has admitted to New and Nonofficial Remedies diarsenol, manufactured by the Synthetic Drug Company of Toronto, Canada, and arsenobenzol made by the Dermatological Research Laboratories, as products essentially the equal of salvarsan. It has also accepted neodiarsenol, manufactured by the Synthetic Drug Company, as essentially equivalent to neosalvarsan. The Council has under consideration at the present time salvarsan manufactured by the Farbwerke-Hoechst Company, New York.

Before accepting these preparations, the Council required evidence to show that the products are manufactured under supervision which may be expected to insure its chemical identity and uniformity and its freedom from toxicity. It should be remembered, however, that, in the past untoward effects have been reported from German salvarsan and neosalvarsan possibly due to idiosyncrasy, but more probably to the fact that certain lots (probably through some faulty technic in the manufacture) were more toxic than others. This has been the case particularly in regard to the last shipments of neosalvarsan from Germany. Recently some untoward effects from neodiarsenol have also been reported. No conclusive evidence is available, we believe, that shows difference in the toxicity or therapeutic efficacy between the German made salvarsan, diarsenol or arsenobenzol (Dermatological Research Laboratories); though reports have been received that the last product, while somewhat less soluble than salvarsan, is more nearly free from toxic action than salvarsan.

Our knowledge as to the manner in which mercury exerts its curative action in syphilis is very uncertain, and whether it acts as a direct parasiticide destroying the spirochetæ or whether it acts by stimulating the formation of antibodies is not known, although Nichols's experiments would go to prove that its effect is that of a spirocheticide. It is also supposed to have an action upon the deposits in which the spirocheta lie encapsulated and dormant, causing them to be set free into the circulation.

Mercury may be introduced into the organism by three routes:

1. Through the skin: (*a*) by inunction; (*b*) by fumigation.
2. Under the skin by hypodermic injection.
3. Through the intestinal canal.

It is eliminated by the kidneys, intestinal glands, and by the mucous membrane of the mouth and salivary glands.

Its excretion is slow and especially so if the insoluble preparations are used, and mercury can be demonstrated in the urine several months after its administration has been discontinued.

It is no doubt true that the long-continued presence of mercury in the organism plays an important part in producing its effect, but to get the most profit from it it is necessary not to give it continuously, but with interruptions, as formulated by Fournier and now generally adopted by syphilographers under the name of the "chronic intermittent treatment."

While it has not yet been proved, still it is by no means improbable that the continued administration of mercury has an effect upon the spirochetæ, in establishing a tolerance to the drug, so that the same moderate doses which were effective in the beginning have no longer the power of destroying them.

In other words, a mercury-fast strain of spirochetæ has been produced by the continuous influence of the mercury.

After a varying quantity of mercury has been given for some time, the blood becomes saturated with it, and this is announced by the occurrence of **mercurial stomatitis,** which is ushered in by certain **prodromal symptoms:**

(*a*) A coppery taste in the mouth.

(*b*) An increased flow of saliva.

(*c*) Slight pain on striking the teeth together.

(*d*) Slight swelling and sponginess of the gums next the teeth.

In mild cases of ptyalism the symptoms all subside in a few days if the administration of the drug is stopped; but if an excessive quantity of mercury has been introduced into the body, or if an unusual susceptibility to the action of mercury is present, the toxemia is indicated by salivation.

The stomatitis has a practical value as a sign that a sufficient quantity of mercury is being given, for if there is no reaction it demonstrates that either not a sufficient quantity of mercury is being administered or it is not being absorbed.

Care should be taken not to push the mercury beyond the point of merely "touching the gums," for if this warning sign is not heeded and the drug is continued severe salivation is caused.

**In severe cases of salivation,** the gum and buccal mucous membrane are greatly swollen and ulcerated. The teeth loosen and fall out, the saliva pours out from the mouth in quantities, even to the extent of several pints a day, and the breath has an intensely fetid odor.

A bad condition of the mouth and carious, broken teeth covered with tartar cause the mouth to react prematurely to the influence of mercury, and for this reason the patient should go to a dentist and have the teeth put in order before beginning treatment.

While patients are using mercury, especially by inunction, it is necessary that they should wash their mouths three or four times a day with strong alum or chlorate-of-potash water, peroxide of hydrogen, or tincture of myrrh. Hospital patients, who, as a rule, do not use the toothbrush, should brush the gums every day with a 3 per cent solution of chromic acid.

Light cases of spongy gums may be treated by brushing them with equal parts of tincture of myrrh and tincture of iodine, followed by a mild mouth wash.

**Treatment of Salivation.**—The fetor of the breath and the ulceration can be best checked by means of chlorate of potash in solution, used as a mouth wash, and it should also be given internally in doses of 20 grains, three times a day. The pain in the gums induced by mastication can be lessened by brushing the gums with a 4 per cent cocaine solution before eating, although in severe cases the patient should be fed upon liquid food. The excessive secretion of saliva is controlled, to some extent, by hypodermic injections of atropine. The gums should be brushed with 3 per cent chromic acid solution, and the ulceration in the mouth touched with a 10 per cent nitrate-of-silver solution. The elimination of the mercury may be aided by giving the patient abundance of water to drink, and causing free purgation.

In addition to noting the condition of the patient's mouth during the administration of mercury, the state of the stomach and intestines should be closely observed, for the occurrence of cramps or diarrhea shows that the limit of dosage is reached.

It is important to *examine the urine* before beginning treatment, for, even although kidney disease may be present, it is safe to administer mercury. If, however, during the course of treatment, albuminuria occurs, it is evident that the kidneys have been affected by the mercury and its administration must be stopped.

In using the inunctions, it is not infrequent that a mercurial dermatitis follows from the local irritation of the ointment, but a dermatitis may also occur when mercury is given internally.

In addition to salivation another effect of mercury is the *mercurial eczema,* which is observed more or less in every case treated by inunctions.

It occurs in the form of small red papules with a pustule at the apex, perforated by a hair, and is caused by the irritation of the follicles of the skin by the mercury. When the papules occur in quantities, that particular part of the skin should not be rubbed at the next application of the mercurial ointment, and, in general, it is better to avoid the hairy parts of the body as much as possible in using inunctions.

## Modes of Administering Mercury

**Inunction.**—The oldest, most extensively used, and at the same time reliable and effective means of treating an ordinary case of syphilis is the method of rubbing mercurial ointment into the skin. At the same time it is generally the preferable plan to use in the presence of grave lesions threatening life or the integrity of vital organs.

The advantage of inunction is its prompt action in saturating the body with mercury, and it is possible to give three times the quantity of mercury in this way which could be given by the mouth. At the same time the stomach digestion is not interfered with, and the patient can assimilate the maximum quantity of food, and his nutrition is maintained.

The mercury, through the friction and pressure of rubbing, is pressed into the open mouths of the sebaceous follicles and sweat ducts in the skin. It is brought gradually in contact with the blood circulating in the capillaries of the papillary layer in the skin, and is believed to be converted into bichloride of mercury through combination with the sodium chloride in the blood. In this soluble form it is thought to pass into the general blood circulation.

It has also been shown by Welander that evaporation of the mercury and its absorption as a vapor through the lungs play an important part in the introduction of the drug into the body, although the major part of the mercury gets into the system through the skin.[11, 12]

The mercury is stored up in the follicles of the skin for a long time after the inunctions have been discontinued, and can be found eliminated by the urine many weeks after the last inunction was given.

The blue ointment, or unguentum hydrargyrum, is the best preparation to use, and it is preferable to have it made after the formulary of the German pharmacopeia, which contains 20 grains of metallic mercury in every dram of lard. In ordinary cases 1 dram is a suitable dose, but in exceptional cases 2 drams may be used.

It is well to have the druggist measure out the daily dose of ointment and enclose it in waxed paper. In very recent times a substitute for the lard, termed *resorbin*, has been used with satisfaction. Resorbin is an emulsion made from almond oil, wax, glue, or soap solution, sometimes combined with lanolin. The advantages over the lard which resorbin possesses are, that it mixes with water, dries quickly, is less dirty, its odor is less unpleasant, and it leaves less deposit on the skin. Resorbin takes the place of lard in the blue ointment in the same proportion.

| | | |
|---|---|---|
| ℞ | Mercury .......................... | 1 part |
| | Resorbin .......................... | 2 parts |

The ointment should be thoroughly rubbed into the skin, selecting a fresh portion of the surface of the body for each day's rubbing, and it is not practicable for the patient to rub himself, but the inunction should be made by an attendant, or *masseur*, who to protect himself from salivation should wear a leather glove.

It requires from twenty to thirty minutes' firm rubbing with the hand to cause the complete absorption of the entire quantity of ointment used, and when the rubbing is completed the skin should not glisten with fat-globules, but have a uniform grayish color.

It is also desirable to make the inunctions in a regular course, as follows:

First day: In the calves.
Second day: Inner and outer sides of the thigh.
Third day: Chest and abdomen.
Fourth day: Flexor surfaces of the arms.
Fifth day: Back.

On the sixth day the patient takes a warm bath with soap, and on the seventh day begins again with another course of rubbings.

The absorption of the mercury takes place partly by inhalation, and for that reason the patient should wear woolen underclothes, which are changed once a week, when the bath is taken, and to get the benefit of the absorption by inhalation the rubbings should be made at night, just before going to bed.

Such a course as outlined above comprises a "tour," and in the average 5 tours, or 30 inunctions, covering a period of five weeks' time, constitute a course. Occasionally it is necessary to give more than 30 inunctions—40, or even 50, depending on the special indications.

The inunctions should be used in both secondary and tertiary periods whenever danger threatens a vital organ, such as the eye, brain, larynx, etc., and also in obstinate ulcerative processes with rapid destruction of tissue.

**Fumigations of calomel** are a useful *adjunct* to other treatment in the cases of early lesions which are extensive and have a tendency to involve the deeper structures, ulcerate, and extend. The calomel fumes come directly in contact with the lesions, and the local action of the vapor of mercury facilitates their healing.

*Method of Application.*—The patient sits on a cane-bottomed chair with a blanket around his neck, falling to the floor and surrounding him in a sort of tent. The head is left uncovered. A tin pan holding boiling water is placed under the chair, and the patient steamed for fifteen minutes. The pan is then withdrawn and 30 grains of calomel are fumigated on a tin stand, over a spirit-lamp placed underneath the chair, and the patient is allowed to remain surrounded by the fumes for half an hour. The fumigation should be employed once a day, until the gums are touched.

**Sublimate baths** are employed in the same class of cases; viz., extensive, ulcerating, suppurating lesions. The intact skin does not permit a trace of sublimate in solution to be absorbed, but absorption can take place through solutions of continuity.

**Intramuscular Injections.**—The practice of treating syphilis by hypodermic injections of mercury was first intoduced by Lewin, formerly chief of the syphilitic service in the Charité, in Berlin.

The salts used are *soluble* and *insoluble.*

Of the **soluble salts,** corrosive sublimate is preferred in the Charité because it is rapidly absorbed and has an intense action.

The solution contains 1 per cent of corrosive sublimate, with the addition of 3 per cent of common salt, which is added empirically, to lessen the pain and danger of causing infiltration in the muscles.

It is the practice in the Charité to give from 15 to 20 injections in all, using 2 c.c., or 30 minims, every second day.

The injections are made with an ordinary hypodermic syringe, provided with a needle which is two inches long and with a thick bore, and the needle is plunged directly downward into the substance of the glutei muscles.

Before injecting, the skin should be cleansed with alcohol-ether rubbed on. After inserting the needle into the muscles the syringe should be removed from the needle for a moment to make sure that a vein has not been penetrated. If this accident has occurred a flow of blood will take place through the needle. If an injection, particularly of the insoluble salts, is thrown directly into the vein, an embolus which lodges in the lungs is very liable to occur.

A great advance in the subcutaneous treatment of syphilis in recent years consists in the introduction of the **insoluble salts of mercury.** The preparations in use today are calomel and salicylate of mercury and gray oil (oleum cinereum).

The calomel is universally held to be the most active and intense in its effects, while the salicylate is milder than calomel, but stronger than the bichloride.

If calomel is selected, it may be used in an emulsion of 1 part of calomel to 10 of olive oil. Of this emulsion, 1 c.c., or 15 minims, is injected once a week, and only from 6 to 8 injections can be given without producing salivation.

As stated above, the salicylate of mercury is milder in its action and less liable to cause sudden salivation than calomel.

In ordinary cases the injection is made once a week, and from 8 to 15 injections are required to cause a disappearance of the symptoms.

| | |
|---|---|
| ℞ Hydrargyri salicylatis | gr. xxiij |
| Lanolini | gr. xv |
| Olei olivæ | ♏ ccxviij |

M. Sig.: Inject 15 minims hypodermatically once a week; 15 minims contain gr. iss of the salicylate of mercury.

Gray oil or oleum cinereum was introduced into practice by Lang in 1884. It is an emulsion of quicksilver finely divided and suspended in oil. It occupies a middle place between the soluble and insoluble injections. Its effect is rather uncertain, and it must be watched carefully to prevent its causing salivation.

A good formula is:

| | | |
|---|---|---|
| ℞ | Redistilled mercury | 20 gm. |
| | Chloretone | 2 c.c. |
| | Anhydrous lanolin | 30 c.c. |
| | Liquid paraffine ............q. s. ad | 100 c.c. |

Dose v minims equals 1 grain, and increase to x minims later if well borne.

The *advantages* of intramuscular injections are, that they act promptly and rapidly, and are quite as efficacious as inunctions. The dosage is accurate, and the injection is only made once a week when the insoluble salts are used, so that the patient is relieved from the annoyance of taking medicine or making inunctions in the intervals.

The *disadvantages* are the *pain*, which is very inconsiderable, and the slight chance of the occurrence of abscess, which seldom happens.

To show how seldom abscess occurs, the author has never seen one in his practice, either in the hospital or in private.

Infiltrations frequently occur, but they are always absorbed without suppurating.

In exceptional cases the oil has been known to form a *pulmonary embolus*, with a localized pneumonia, but recovery followed in each case, and, if the manner of separating the syringe and needle after its introduction, to note if a vein has been punctured, is always practiced, the danger of embolus is reduced to practically nothing.

*Salivation* may occur in a small proportion of cases, without any previous warning, after one or two injections, and, as the deposit of mercury is in the muscle, we can not stop its absorption unless an incision is made into the muscle and the small mass of mercury removed by a curette.

As a rule, however, patients can tolerate half a dozen or more injections before the gums are touched, and an improvement in the lesions is noted after the first injection, which continues progressively under the repetition of the dose.

## Administration of Mercury by the Mouth

The routine treatment of syphilis by administering mercury by the mouth is a method which should be relegated to the dustheap of antiquity.

Probably more cases of tabes and general paresis are due to the mistaken confidence reposed in the effectiveness of mercury given internally than to any other cause, while it is true that a good many cases of syphilis have been cured by the long-continued internal treatment a great many others have not been able to take a sufficient quantity of mercury in this way to destroy the spirochetæ, and have developed the terrible consequences of an uncured syphilis, such as tabes or paresis, many years after the original infection.

If mercury is given by the mouth, after a certain length of time the absorptive powers of the intestinal canal often become impaired, and the mercury passes through the alimentary tract unchanged and without being absorbed. Its continuous use for a long period of time often causes anemia, emaciation, and diarrhea, and as stated before, it is probable that the spirocheta become resistant in the constant presence of small quantities of mercury so that it has no longer any parasiticidal effect upon them.

Some of the preparations of mercury used for internal administration are as follows:

**Preparations of Mercury.**—*Pills of protiodide of mercury* (Lamoureux & Garnier), $\frac{1}{5}$ grain each.

*Method of Administration.*—One pill is given three times a day three-fourths of an hour after eating, and every third day the dosage is increased by one pill. For example, the patient takes 3 pills for three days, and on the fourth day he takes 4 pills, and on the eighth day the dose is increased to 5 pills, and so on up to the *point of tolerance,* which is usually from 10 to 15 pills or more.

The point of tolerance is not manifested by ptyalism, except in rare instances, but by *diarrhea* and *cramps.* When these symptoms occur, the dosage is reduced to a point just short of producing cramps, and, after the maximum dose is reached, it is maintained without reduction throughout the whole course of the disease, unless anemia, emaciation, diarrhea, or salivation is produced by it.

*Mercury with Chalk* (*Hydrargyrum cum Creta*).—This is a mild preparation, and is not apt to produce colic, and for that reason it may be given when the protiodide causes too much diarrhea. The method of administration is similar to that of the protiodide. It may be given in 1-grain pills and increased to the *point of tolerance,* which is manifested by either ptyalism or diarrhea.

*Bichloride of Mercury.*— Dose. $\frac{1}{30}$ to $\frac{1}{15}$ grain. This form of mercury is very useful, and is of particular value, given in combination with iodide of potassium, later in the disease, in the form of the so-called mixed treatment.

*Tannate of Mercury.*—Dose $\frac{1}{2}$ to 1 grain three times a day. This is one of the newer preparations, and it is said to have the advantage of causing very little irritation to the intestinal canal.

### Value of the Different Methods of Administering Mercury

The relative values of the treatment by inunctions and the corrosive-sublimate intramuscular injections for the routine treatment of an ordinary case of syphilis are about equal, and the writer is in the habit of explaining the advantages and disadvantages of each to the patient, and allowing him to make his own selection, with the proviso, however, that the inunctions must be made by an attendant and not by the patient himself.

All patients should be individualized, for fat people, pregnant women, old people, and debilitated and run-down individuals do not stand injections well, and in such cases treatment by inunctions should be employed.

The injection of the insoluble salts has its own particular field of use and should not be employed in the routine treatment without some special indication.

Calomel injections are the most active and intense in their effects, and for this reason they are indicated after salvarsan has been used, to cause a softening of the encapsulations surrounding deposits of spirochetæ and set them free in the circulation, when they can be destroyed by subsequent calomel injections.

They are also useful in obstinate tertiary affections which do not heal because of frequent relapses.

Calomel injections were formerly used in malignant syphilis, but have now been supplanted by salvarsan in those conditions.

The salicylate of mercury is called for in the cases where calomel injections cause too much salivation and a milder method is demanded, and they are especially useful in the obstinate affections of the mucous membranes and palmar syphilides.

The internal treatment is most uncertain in its working, but must be used with exceptional patients who do not tolerate inunctions or injections.

Too much reliance is placed, in America, upon the treatment of syphilis by the exclusive use of internal medication, and the author believes that many cases of late tertiary lesions of the brain or nervous system would not have occurred if the patient had been subjected to several vigorous courses of treatment by inunctions or injections during the first two and a half years of the disease.

## IODIDE OF POTASSIUM

The iodide of potassium has no direct action in destroying the virus of syphilis, and consequently it is of no use early in the disease. Its action is to cause the absorption of the new growth infiltrating the arteries and which, when it occurs in other tissues, is known as gumma. The iodide in small doses acts as a tonic, and increases appetite, nutrition, and tissue change.

The unpleasant effects which are induced by iodide of potassium are *coryza* and *lachrymation*, and an *eruption* upon the skin, which usually occurs upon the back, chest, and face, or small acneiform pustules. In rare cases large bullæ may form or the eruption may be *hemorrhagic* in character and resemble purpura.

In addition, there is often a condition of anemia, weakness, and general malaise induced. These symptoms are all less apt to occur if the kidneys secrete freely and the iodide is rapidly eliminated.

### Dose and Administration

The only rule for the size of the dose is the effect produced upon the lesion. For the ordinary routine treatment, during a period of latency, 90 or 100 grains a day are enough, but in the presence of a grave lesion of the nervous system or viscera ½ ounce, or even 1 ounce, in the day may be required to save life.

Iodide of potassium is best given in saturated solution, 1 minim of distilled water representing 1 grain of the salt. It should be given in milk or largely diluted with water, and preferably two hours after a meal, as the iodide combines with the starch in the stomach and forms iodide of starch, which is inert.

When the drug disagrees with the stomach and disturbs the digestion, it may be given in milk, which is coagulated with essence of pepsin, or the patient may be directed to drink one or two glassfuls of hot water immediately after taking the iodide.

While a small dose of iodide may cause such marked symptoms that the patient insists he can not continue with it, it is remarkable what very large doses of the drug are generally well borne. In these cases where iodide of potassium is imperatively called for, it will be usually seen that if the dosage is rapidly increased the patient soon becomes accustomed to the drug, and the unpleasant symptoms disappear.

In very exceptional cases, salivation of a mild grade has followed the administration of iodide of potassium, and this is especially the case where mercury has been previously given, and sometimes iodide of potassim has a bad effect upon the heart, causing feebleness of its action, and blueness of the lips and extremities.

When the patient can not tolerate iodide of potassium for any of the above reasons, *iodide of soda* can be used in its place, in doses of from 60 grains up to 300 grains.

This is a much weaker preparation, but does not affect the heart.

IODIPIN is a remedy introduced into practice a few years ago, and is active and useful, but not as efficient as the iodides, and should be used only when they are not tolerated.

It may be given by the mouth in dram doses of a 10 per cent solution, three times a day, with a few drops of aqua menth. pip. as a corrective. Its chief field of usefulness, however, is by hypodermic injection, and from 80 to 150 minims of a 25 per cent solution should be given at a time for several days, employing the same technic as for the injection of the insoluble mercurial salts.

The iodipin forms a deposit in the tissues, from which it is slowly absorbed.

Finger summarizes its advantages as follows: 1. Complete but gradual absorption of the injected iodine. 2. Rapid disappearance of the iodism. 3. Avoidance of the intestinal disturbance, which occurs frequently with iodide of potassium. 4. Possibility of administering it to patients with cerebral syphilis who refuse to swallow. 5. Possibility of subjecting the patient to the continuous absorption of iodipin for weeks or months after a short course of injections.

### Zittmann's Decoction

This is one of the officinal preparations of the pharmacopeia, and is composed of a number of vegetable bitters, together with a minute quantity of metallic mercury. Its action is first purgative and later tonic, and in some way, which is not understood, it exercises a most beneficial effect in indolent, spreading ulcerations which do not respond to mercury and iodide of potassium. These lesions occur chiefly in malignant syphilis affecting persons of feeble vitality, who are usually of the tubercular diathesis and who can not tolerate mercury or iodide of potassium in any considerable quantities. It is in such cases as these, says Cooper*, that the Zittmann treatment proves most effectual. A fortnight's treatment with this remedy will arrest the disease and will cause rapid healing and cicatrization of the lesions. The principle of the treatment consists in eliminating the poison from the system by sweating and purgation. The patient is kept in a room the temperature of which is maintained at 80° F.

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*Alfred Cooper, Practitioner, London, July, 1904.

Zittmann's decoction formerly was only used for malignant syphilis, and in patients who showed an intolerance of medication. As salvarsan exerts an effect upon such cases in healing the lesions with wonderful rapidity, Zittmann's decoction is practically no longer used.

The evening before commencing the treatment two of the following pills are administered:

| | | |
|---|---|---|
| ℞ | Hydrarg. chloridi mitis | gr. ij |
| | Ext. colocynthidis | gr. v |
| | Ext. hyoscyami | gr. ij |

The diet is regulated, and for the first four days the patient drinks half a pint of the following decoction, as hot as possible, at 9, 10, and 11 A.M. and at 12M.

DECOCTION I

| | | |
|---|---|---|
| ℞ | Rad. sarsæ contus. | ℥iv |
| | Sem. anisi contus., | |
| | Sem. fœniculi contus. | āā ʒviiss |
| | Fol. sennæ | ℥j |
| | Rad. glycyrrh. contus. | ℥ iv |

Add, in a linen bag:

| | | |
|---|---|---|
| ℞ | Sacchar. alb., | |
| | Alum. sulph., | |
| | Hydrarg. chloridi mitis | āā ʒiss |
| | Hydrarg. bisulph. rub. | ℈j |
| | Aquæ | Cong. iij |

Boil gently down to 1 gallon, strain, and put into four 40-ounce bottles.

On the same days, at 3, 4, 5, and 6 P.M., half of the following decoction, which is taken cold:

DECOCTION II

To the dregs from No. 1 decoction add:

| | | |
|---|---|---|
| ℞ | Rad. sarsæ contus. | ℥ij |
| | Cort. limonis contus., | |
| | Sem. cardamomi contus., | |
| | Rad. glycyrrh. contus. | āā ʒj |
| | Aquæ | Cong. iij |

Boil gently down to 1 gallon, and put into four 40-ounce bottles.

The patient is kept in bed, except for an hour every evening, when he may sit up. On the fifth day he is given a hot bath and allowed to get up. In the evening 2 pills are administered, the patient starting the decoctions again on the next day, as before. This treatment goes on in the same way until the fifteenth day, when it is discontinued.

**The hot springs of Arkansas and Aachen in Germany** are useful in the same class of cases, viz., inveterate syphilis occurring in feeble individuals whose susceptibility to mercury and iodides is so extreme that they can not be administered in sufficient doses to hold the disease under control. The water of these springs contains very little mineral substance, but has a temperature of 140° F. as it issues from the earth. Its action is to cause free secretion by the kidneys and skin, and, while it has no specific action upon the lesions of syphilis, it increases the *tolerance* of the body and enables the patient to take large doses of mercury and the iodides.

Treatment at the hot springs is unnecessary for a patient who is able to take mercury and iodide of potassium in the ordinary doses, and it is only the exceptional individual who requires to be treated at one of these resorts, and since the employment of salvarsan in malignant syphilis, it is rare to find a patient who can not be well taken care of at home.

**The serum treatment of syphilis** has, up to the present time, been entirely without success, although many attempts have been made to produce an antisyphilitic serum.

The difficulties in the way are obvious: first, the pathological germ of syphilis has not yet been cultivated; second, the immunity of all the animals, except apes, to syphilitic infection precludes their use as mediums of cultivation.

Among the recent attempts reported at making an antisyphilitic serum are those of Risso and Cipolina,[1] who injected a number of dogs with blood obtained from patients in the secondary stage of syphilis who had never had any syphilitic treatment.

The blood of these animals was taken, and the serum was made so as to contain not only the blood serum of the animal, but also the active principle of the corpuscles, and solid contents of the blood.

Sixteen patients were injected with the serum so prepared, and with reported improvement.

Metchnikoff's experiment may also be mentioned. He inoculated 6 apes (Makkaken) with syphilis, and no symptoms occurred, showing their immunity. He then took the serum from these apes and inoculated chimpanzees, and they also appeared to be rendered immune.

The matter at present is entirely too hypothetic to be of any value, and since the discovery of salvarsan experimentation along the lines of serum treatment has come to a standstill.

## THERAPEUTICS OF SYPHILIS

It is of the highest possible importance for the future welfare of the patient with syphilis that treatment is begun as soon as the diagnosis is made. By intensive treatment in the primary stage as soon as spirocheta have been discovered with the dark-field, there is a fair possibility of curing the patient with one course of treatment. If this good result is not attained, we can at least, by vigorous treatment in the primary and secondary state, almost positively prevent the occurrence of tabes and syphilis of the brain or viscera in the tertiary period and in the presence of any suspicious sore the watchword should be "early diagnosis and intensive treatment."

Since the introduction of salvarsan the practice has changed entirely in regard to withholding constitutional treatment until the appearance of secondary manifestations, and it has been found that we can exert a powerful influence upon the disease by beginning treatment at once by intravenous injections of salvarsan as soon as microscopic examination of the primary lesion has disclosed the spirochetæ.

It is also desirable to excise the chancre when it is located in a position where such a procedure is practicable.

When salvarsan was first introduced into practice, it was supposed that a sufficient sterilizing effect upon the spirocheta would be attained by one dose.

It has been found that one intravenous injection of salvarsan is of very little use. It kills, to be sure, a great many spirochetæ, but not all of them, and the spirochetæ remaining grow and increase and relapses invariably occur. These relapses occurring after the administration of one intravenous injection of salvarsan are more severe than those under mercurial treatment, which is explained in this way: After the slow effects of mercury, antibodies are formed. These antibodies protect the tissues, but with the rapid destruction of many spirochetæ after salvarsan there is no stimulant to the development of antibodies and the body is entirely unprotected. On account of the deficiency of antibodies the relapse is more severe than if no salvarsan had been given at all. On account of this it is now the universal practice to give from four to six intravenous injections of salvarsan at weekly intervals and follow them by the administration of mercury by injection, usually preferring the salicylate of mercury.

Under this intensive treatment, if begun early, there is a possibility that in 50 per cent of the cases the Wassermann will become negative and remain so permanently after one course of treatment.

The hygiene and general condition of the patient beginning treatment for syphilis should also be looked after and on beginning treatment he should be sent to a dentist to have his teeth examined, for teeth which are broken or carious cause the mouth to react too quickly to mercury, and salivation may result.

He should also be instructed as to the hygiene to be maintained during the course of the disease. Everything should be done to maintain the bodily health and nutrition; plenty of sleep and exercise in the open air, abundance of plain, nutritious food, and freedom from overwork or anxiety should be insisted upon.

The use of tobacco should be interdicted, as it causes an irritation of the mucous membrane of the mouth, which predisposes to the formation of mucous patches and chronic ulceration and tends to retard their healing.

Alcoholic drinks in strict moderation may be permitted in the shape of small quantities of beer or light wine, taken preferably with the meals. The habitual use of whiskey is injurious.

The patient should be instructed with regard to the danger of communicating syphilis to others, through the medium of a cup, spoon, pipe, towel, or other utensil, and by means of sexual intercourse or kissing.

## Routine Treatment of an Ordinary Case of Syphilis

The opinion at the present time among syphilographers is that the best results in rapidly and completely destroying the spirochetæ and so curing the syphilis, are obtained by the combined use of salvarsan, mercury, and iodide of potassium.

With mercury the spirochetæ are not killed *en masse,* but are destroyed slowly and by degrees, and the natural defenses of the organism—the antibodies—are gradually brought to bear against the infection, and the patient goes more or less definitely through the various stages of the disease as would be the case if he were untreated.

Even if he relapses he has the defensive asset in the mercury he has taken already. In using salvarsan the effects are different; the great bulk of the spirochetæ are killed at once and those that remain are too few to stimulate the resistance of the body, and they begin again to multiply. When a relapse takes place, as it usually does, the body is unprepared to cope with the newly formed spirochetæ.

The advantages of the combination method are that the immediate effect of the salvarsan is to kill large numbers of the spirochetæ, while the mercury, by its superior penetrating power, softens the encapsulations and destroys the spirillæ which were in deposits in various organs out of reach of the salvarsan.

The iodide of potassium has no direct action on the virus of syphilis, but it stimulates the activity of the lymphatic system, facilitates getting rid of waste products, and also causes the absorption of any syphilitic infiltration which may have taken place in the tissues or arteries.

Having studied the effects of the three antisyphilitic remedies we are in a position to draw up a plan for putting them in use.

An additional aid in the treatment of syphilis is the application of the Wassermann reaction, since before its introduction there was no means of knowing whether a syphilis which presented no lesions was cured or only latent. This necessitated a schematic empirical treatment which was applied to all cases alike. At the present time, with the assistance of the Wassermann reaction, we stand in a position to know accurately and definitely how active a treatment is called for.

The plan of treatment which is followed in a general way today by all syphilographers and which we use in our clinic in the Long Island College Hospital is as follows:

All cases of syphilis, whether primary, secondary, or tertiary, no matter whether active or latent, are treated by the combined use of salvarsan and mercury. An intravenous injection of old salvarsan is given and repeated from four to six times at weekly intervals, and either coincident with or following the completion of the salvarsan treatment, mercury is administered hypodermatically. The salicylate of mercury is the form generally used and from eight to twelve injections at weekly intervals constitute a course.

Instead of using the salicylate we sometimes use calomel, but calomel has the disadvantage that while it is very intensive in its action, it is very apt to cause salivation. Its injection is likely to cause a good deal of pain and salivation comes on without warning, so that the use of salicylate of mercury is the safer plan and it acts in a milder way than the calomel.

Gray oil may be used instead of salicylate; or calomel or injections of the soluble salts, such as corrosive sublimate, may be given every other day.

After a course of treatment as described has been carried out, a pause of from six to eight weeks is made and then a Wassermann test is made in order to see whether enough treatment has been given for the time being or not. If the reaction is negative we wait one or two months and make another Wassermann. If the test is still negative we wait and make repeated Wassermanns until we find that the Wassermann becomes positive or remains negative. If positive, another course of salvarsan and mercury is given.

The test of a cure is a permanently negative Wassermann, but we must insist on a negative Wassermann reaction lasting for at least one year before we can discharge the patient from observation. Of course, the earlier the treatment is begun the more successful we are in getting a negative Wassermann after one course of salvarsan and mercury.

The latent and tertiary cases, as a rule, require several courses of injections of salvarsan and mercury in order to get a permanently negative Wassermann. It requires two, three or four courses of the combined treatment as a rule to get a Wassermann permanently negative in these patients, but if we persist in repetitions of the treatment for a long enough time we can generally get a permanently negative reaction, although sometimes it is impossible to accomplish this result.

If the Wassermann remains permanently unchanged by treatment, the patient may be considered as "Wassermann fast," and treatment discontinued. If, however, the Wassermann is reduced by treatment to weak positive or negative, and then on cessation of treatment returns again to positive, it is an indication that the patient requires more treatment, for it is considered that a relapse from a negative Wassermann after treatment to a positive denotes that there are still spirochetæ in the body which have not been destroyed by the treatment. The usual time for such a relapse is from three to six months after the treatment is ended.

After the completion of a course with salvarsan and mercury, if the Wassermann reaction is negative, all treatment may be suspended for two to three months.

If after a couple of months the Wassermann becomes positive again or secondary lesions appear, a repetition of the salvarsan and mercury, or either alone or together, is called for.

The Wassermann should be repeated three or four months later, and treatment instituted or not as the Wassermann reaction and symptoms indicate during a period of two or three years.

In this way the treatment of syphilis, instead of being conducted as formerly upon a purely empirical and arbitrary scheme, is now based upon scientific observations proving that by the effects of treatment the poison upon which the disease depends is actually neutralized.

Iodide of potassium has never been supposed to have an effect in destroying the virus of syphilis, but is only used to help the body rid itself of the newly formed round-celled infiltration deposited in the tissues as a result of the irritation of the virus and to prevent arteriosclerosis.

Its use is still called for in the late secondary and tertiary stages, and after several courses of mercury and salvarsan it is useful to give 50 grains a day for three or four weeks.

During the course of the disease the general nutrition of the patient should receive the closest attention during the protracted treatment. Syphilis itself is a debilitating disease, and mercury, if administered for a long time, has the effect of causing a condition of pallor and anemia. Of course, when such an effect is induced, the mercury should be stopped and tonics given.

**Tonics** are usually required at some stage of the disease, to counteract the destruction of red corpuscles caused by the virus. The anemia is treated with iron, and the nervous system and general nutrition are stimulated with strychnine. Codliver oil is very valuable for the emaciation and loss of weight, and especially so if there is a complication of tuberculosis. Close attention should also be paid to the matters of fresh air, exercise, food, sleep, and freedom from anxiety.

In order to keep watch on the patient's general condition it is desirable to keep a record of his weight, and it is not a difficult matter to make frequent tests with a hemoglobinometer, to see that the normal standard of hemoglobin is maintained.

The urine should be examined every week, to make sure that the administration of mercury has not caused a nephritis.

A free elimination of the morbid products through the skin should be assisted by diaphoresis in a Turkish bath, without the cold plunge a couple of times a week; except during the inunction courses.

## MALIGNANT SYPHILIS

In the cases of malignant syphilis that are accompanied by extreme ulcerations on the skin, the permanent formation of gummata and severe cachexia, salvarsan is the sovereign remedy, and should be used as early as possible in the disease.

Such patients tolerate mercury badly, becoming easily salivated so that the use of mercury may have to be omitted in such cases if found to disagree.

In addition to salvarsan for its spirocheticidal properties, iodide of potash in large doses is required to bring about the absorption of the early gummatous infiltrations.

Zittmann's decoction was formerly an important remedy in this class of cases; but since the introduction of salvarsan, it is rarely used.

As these patients are all cachectic, hygienic treatment—consisting of good food, good hygienic surroundings, sunlight, fresh air, and tonics—is imperatively demanded in these cases.

## TREATMENT OF TERTIARY LESIONS OF THE VISCERA AND NERVOUS SYSTEM

We have already seen that syphilis destroys life through the lesions which it induces in important viscera or the central nervous system.

If the patient is unfortunate enough, through insufficient or incorrect treatment, to have vital organs invaded by syphilitic endarteritis and periarteritis and infiltration, it is necessary to attack the disease vigorously in the hope of destroying the spirochetæ and causing absorption of the new infiltrations, and so restoring the organ to its normal condition. To this end salvarsan, mercury, and iodide of potash must all be used, but in a somewhat different manner from the routine administration in an ordinary case.

In syphilitic aortitis, aneurysm, and heart disease, it is better to begin the treatment with several intramuscular injections of mercury, the salicylate being the form generally used. Salvarsan should be administered intravenously afterwards, beginning with a dose of 0.3 and increasing if it causes no reaction. In these cases the course of treatment should be finished by the administration of iodide of potash in increasing doses.[13]

While the iodide has no spirocheticidal effect, it has always been used for its action in causing the absorption of newly formed gummatous tissue, and it is constantly demanded in the gummatous tertiary lesions in large doses.

The same rule of preceding the salvarsan with several injections of mercury and following it by iodide of potash in large doses should be always employed in syphilis of the nervous system, especially the brain.

The possibility of the development of a Herxheimer reaction, with swelling and edema in and around the lesions, causing pressure effects accompanied by convulsions, localized paralysis and sometimes death, must be borne in mind in treating syphilis of the brain.

The patient is best protected from these untoward effects of the treatment by using mercury before the salvarsan, and giving the salvarsan in small doses at the beginning, and finishing with iodide of potash in large and increasing doses.[14, 15]

The lesions which are responsive to the treatment just described are certain types of endarteritis, localized gumma, periostitis involving the meninges, and disseminated forms of meningitis.

There are certain forms of gummata and chronic meningitis with severe headaches and endoarteritis, with symptoms such as irritability, loss of memory, and inability to concentrate, which do not yield to the ordinary treatment as will the conditions formerly called "para-syphilis;" i.e. tabes and general paresis.[16]

Salvarsan introduced into the blood in cases of tabes does not reach the spinal fluid, for the cerebrospinal meninges have no selective action on salvarsan, and the interchanging between the blood and spinal fluid is very slight, so that it is not uncommon to find a negative Wassermann in the blood and positive findings in the spinal fluid. In this way the resistance of certain types of syphilis to the ordinary methods of treatment can be explained.

## INTRASPINAL TREATMENT OF TABES AND PARESIS BY SALVARSANIZED SERUM

The direct treatment of syphilis of the central nervous system by injection into the spinal canal was first carried out by Swift and Ellis of the Rockefeller Institute.[17, 18, 19, 20] They first tried salvarsan and neosalvarsan dissolved in serum injected into the spinal canal of animals, but found it too irritating to use and followed by strong reactions. Further experimentation evolved the plan which is now in general use.

## Technic of Administration of Salvarsanized Serum

The patient is first given an intravenous injection of 0.5 or 0.6 of salvarsan. One hour later 30 or 40 c.c. of blood is drawn from the patient's vein and allowed to stand for four hours until the serum is separated. The serum is placed in the ice box overnight, and heated for 30 minutes at 56° C. to inactivate it and kill the complement, so that the salvarsan and antibodies can unite with the spirochetæ and syphilis toxins.

After the serum is prepared, a lumbar puncture is made and 30 c.c. of spinal fluid are drawn off and then the salvarsanized serum at body temperature is injected into the spinal canal. The patient must be kept in bed for at least twenty-four hours after the spinal injection.

The technic of preparing the salvarsanized serum for intraspinal injection has recently been modified by Fordyce, and is described by him in a personal communication to the author. Fordyce states that better therapeutic results are obtained by using the reinforced serum, but that it is more liable to be followed by reactions than when the simple blood serum is used alone.

The method of preparing the reinforced serum is described by Fordyce as follows:

The following is the method he employs in giving the intraspinal treatments:

"The patient is given an intravenous injection of salvarsan in the usual manner; within an hour 50 c.c. of blood are withdrawn and placed in the ice box overnight. In the morning the blood is centrifuged and then the clear serum is pipetted off; the clear fluid is again centrifuged to throw down any blood cells that may be present. We obtain by this method between 20 c.c. and 30 c.c. of serum. This is sometimes given alone in cases of advanced tabes, but as a rule we fortify the serum by adding to it a definite quantity of salvarsan which is obtained in the following way:

"A solution of salvarsan is made so that 0.1 gm. is dissolved in 30 c.c. Of this we take 10 c.c. and dilute it with 0.5 per cent salt solution to 35 c.c.; 1 c.c. of the latter solution equals 1 mg. We seldom begin with a larger dose than 1/10 of a milligram and increase this to ¼ or ½ in suitable cases. Larger doses of salvarsan can be given in high tabes and paresis than in low tabes.

"After the addition of the salvarsan the serum is heated for one-half hour at 55° C. We believe the heating adds to the therapeutic powers of the drug.

"Before administering the serum we withdraw about 15 or 20 c.c. of spinal fluid for examination, then permit about 40 c.c. to run into the receptacle to which we add the salvarsanized serum. After the administration of the serum the patient is directed to remain quiet for at least forty-eight hours, preferably for a longer time. Patients so treated seldom have any reaction, except in the early stage of treatment when the tabetic pains are usually accentuated. With the progress of the treatment the reactions become less and less intense. The cases favorable for the treatment are those with relatively high lymphocytosis, positive Wassermann and positive globulin. We have, however, had favorable results in cases with a low cell count where the other phases are positive. Patients with the so-called cerebrospinal syphilis respond very rapidly to this method of treatment. The least favorable are cases of paresis, but we are sometimes astonished at the marked improvement which these cases show. Whether the improvement will be permanent or not I am unable to say at this time."

The technic is simple with the assistance of the laboratory workers in preparing the serum, but the results as shown clinically have been very satisfactory. The serologic results, as shown by examination of the spinal fluid each time, show an improvement, the Wassermann becomes negative, the globulin content disappears and the spinal fluid becomes a clear normal secretion after a few injections into the spinal canal. The injections should be continued in the spinal canal at intervals of two weeks until a serologic cure is obtained, which may require from ten to twenty injections.

Arsenic has been found in testing the salvarsanized serum in very minute traces in about half of the cases treated. Its action may be due to one of several factors. (1) The serum is spirochetícidal. (2) It may contain specific antibodies. (3) The local irritation may increase the permeability of the meninges. (4) The acute irritation it produces may have a beneficial effect on the chronic inflammatory process. (5) The normal serum may contain substances which, brought into contact with the syphilitic exudate, cause it to resolve. The spirocheticidal effect has been demonstrated by Swift and Ellis, and, although the syphilitic antibodies are not directly demonstrable, it is reasonable to suppose they exist.

An improvement is also noted in the clinical symptoms of tabes. The gastric crises subside and the gait improves. If the disease is of long standing and the cells of the posterior nerve roots have been destroyed by the contraction and pressure of the newly formed scar tissue, a regeneration does not take place and the patient's gait remains ataxic, but the disease is arrested and does not progress further. This in itself is a very great gain, for tabes under any other method of treatment constantly grows worse until finally the patient is incapacitated.

The treatment of *paresis* by this method has been disappointing, although the number of remissions and the amount of improvement under salvarsan and serum intraspinally is many times greater than the number of remissions in untreated paretics; and although a serologic cure may sometimes be obtained, the ultimate outlook is usually bad.[21, 22]

These observations in regard to improvement and cure of tabes and paresis have been made by a number of workers, among whom may be mentioned Swift and Ellis, and Fordyce; and in the Long Island College Hospital, Warren, Tilney, and the author have tried out and confirmed the above-described results in a large series of cases.

## LOCAL TREATMENT OF LESIONS

It has been found that the direct contact of a mercurial preparation with a local syphilitic lesion hastens its disappearance by absorption. An advantage is sometimes taken of this fact by using fumigation or bichloride baths, in addition to the regular general treatment, to accelerate the healing of extensive, widespread, ulcerating lesions of the skin.

**The papular eruptions on the face** are annoying and unsightly, and can be made to clear up more quickly by rubbing in an ointment of the white precipitate of mercury, or mercurial plaster may be laid over the spots. They should be always treated, because if they are neglected they are apt to leave a pigmentation upon the former site.

**Mucous Patches.**—If mucous patches exist in the mouth, they are always of danger to innocent people, since their secretions may be conveyed upon some utensil and be inoculated into another person. On this account we should endeavor to heal them as quickly as possible. In addition to the frequent use, by the patients, of a mouthwash of chlorate of potash or calomel and lime water, the patches themselves should be brushed over once a day with a 1 per cent solution of corrosive sublimate.

The acid nitrate of mercury, in the strength of 1 part to 10 or 20 of water, is also an excellent preparation to use, and it also acts brilliantly in clearing up ulcerating and infiltrated patches which often occur on the tongue in late syphilis (Sherwell).

**Condylomata** heal readily under the general mercurial treatment, and it is only necessary to keep them clean; cover them with a dusting powder, which absorbs their secretions, and prevent contact with other parts and chafing by means of absorbent cotton interposed.

Another very convenient way of treating them is by a mixture of calomel with salt solution. This makes a thick paste, with which the condylomata can be covered.

**Frambesia of the scalp,** the so-called macaroon syphilide, may be treated by using an application of the following:

℞ Alum,
Powd. camphor,
Plumbi carbonat ................āā parts ij
Hydrarg. bichlor. ................. parts iv
Spts. vini diluti,
Acidi acetici pura...............āā parts xlv
M. Pour off the supernatant fluid.

The thick, pasty fluid at the bottom is to be brushed on the lesions.

**Ulcerating Gummata.**—When the floor of a gummatous ulcer is the seat of granulations, the curette should be freely used, to cut them away; or if the membrane is necrotic, it may be encouraged to slough off under poultices or gauze compresses wet with liquor aluminii acetatis.

The healthy granulating surface may afterward be covered with iodoform gauze, or Taylor advises a mild mercurial ointment with balsam of Peru ʒj to the ounce. An active internal medication must also be followed.

After the lesions are dry and infiltrated, mercurial plaster should be used as a local application.

## Duration of Treatment

When the patient first presents himself for treatment in the secondary period, his first question is: "How long will the treatment continue?"

Formerly, under mercury alone, we could answer the duration of treatment is two and a half years, and our answer was based on purely empirical grounds. The length of time which the patient must be treated depends largely on how soon after infection treatment is started. If intensive treatment with salvarsan and mercury is begun in the primary or early secondary stage, a clinical and serologic cure should be obtained with two or three full courses of treatment. If the patient presents himself with an old tertiary condition and visceral or nervous lesions, the duration of treatment and number of courses required is indefinite.

In any case, however, the effects of treatment should be continually observed by the Wassermann reaction, and should only cease when the reaction becomes negative and remains so permanently, for, even though the patient be free from symptoms for many years, it is impossible to say that the syphilis is cured until we are assured by repeated examinations at intervals that the Wassermann reaction and spinal fluid have become permanently negative.

### BIBLIOGRAPHY

[1] Beeson, B. Barker: Urol. and Cutan. Rev., June, 1916.
[2] Sauphor: Bull. Soc. Med. des Hopitaux, 1915.
[3] Corlett, Wm. T.: Jour. Am. Med. Assn., Sept. 20, 1913.
[4] Perkins, Chas. E.: New York State Jour. Med., July, 1912.
[5] Jeanselme: Presse méd., Oct. 22, 1913.
[6] Nelson and Haines: Jour. Am. Med. Assn., March 28, 1914; Ibid., Dec. 26, 1914.
[7] Whitehouse and Clarke: Jour. Cutan. Dis., 31.633, 1913.
[8] Trimble and Rothwell: Jour. Am. Med. Assn., Dec. 30, 1916.
Ormsby, O. S.: Jour. Am. Med. Assn., March 31, 1917.
[9] Lesser, Edmund: Haut und Geschlechtskrankheiten, 1904.
[10] Pusey, Wm. A.: Syphilis as a Modern Problem, 1915.
[11] Wile, Udo J.: Jour. Am. Med. Assn., Apr. 7, 1917.
[12] Schamberg, Jay F.: Jour. Am. Med. Assn., Jan. 19, 1918.
[13] Brooks, Harlow: New York State Jour., Apr. 16, 1916.
[14] Fordyce, J. A.: Am. Jour. Med. Sc., Oct., 1916.
[15] Fordyce, J. A.: Jour. Am. Med. Assn., Oct. 5, 1912.
[16] Fordyce, J. A.: Jour. Am. Med. Assn., Aug. 15, 1914.
[17] Swift and Ellis: New York Med. Jour., July 13, 1912.
[18] Swift and Ellis: Arch. Int. Med., Sept. 1, 1913.
[19] Swift and Ellis: Am. Jour. Med. Sc., Oct., 1916.
[20] Fordyce, J. A.: Jour. Am. Med. Assn., Aug. 15, 1914.
[21] Sachs, B.: Jour. Am. Med. Assn., Sept. 1, 1917.
[22] Fordyce, J. A.: Jour. Am. Med. Assn., Nov. 3, 1917.

# LIST OF GENITOURINARY INSTRUMENTS REQUIRED

## FOR OFFICE USE

Urological table for cystoscopy and urethroscopy.

Valentine's irrigator.

Ultzmann's syringe.

Large metal and glass syringe, capacity 4 to 6 ounces.

Kollmann-Frank irrigating dilator for the anterior urethra.

Kollmann-Frank irrigating dilator for the posterior urethra.

Kollmann's straight dilator for the anterior urethra.

Ultzmann's brush apparatus.

Otis urethrometer.

Eighteen steel sounds, Van Buren curve. Number 16 to 34 French, inclusive, but omitting every other number.

Guyon sounds, 16 to 34 inclusive, omitting every other number.

Tunneled sounds, numbers 12, 14, 16, 18, and 20 French.

Psychrophore with Benique curve; attached to four-quart douche-bag.

Bougies à boule, metal; numbers 16 to 32 inclusive, omitting every other number.

Guyon's flexible gum-elastic bougies à boule, 16 to 30 French, omitting every other number.

One dozen whalebone guides.

Thompson's searcher for stone.

Nitze observation cystoscope with irrigation attachment for washing and filling bladder.

Nitze double-barreled catheterizing cystoscope for catheterizing ureters, with irrigation attachment.

Luys' segregator.

Urethroscope with light-carrier for anterior urethra.

Four tubes, 24, 26, 28, and 30 French.

Wossidlo's irrigation urethroscope for posterior urethra for diagnostic purposes.

Swinburne's posterior urethroscope for applications to posterior urethra.

Dry-cell battery, or transformer for street current.

Electrodes, rectal and urethral.

Needle for electrolysis of Morgagni's crypts.

Long urethral forceps.

Hypodermic syringe for injecting mercurial salts.

Catheters: Soft rubber. Silver, with prostatic curve. Woven silk coudé and bicoudé (prostatic). One Gouley tunneled silver catheter, English, with stylet. Ureter catheters.

Flexible bougies, from number 18 down to smallest.

Microscope, oil immersion, stains, etc.

Dark-field condenser, lamp, and transformer for finding spirochetæ.

# PRINTED SLIPS OF INSTRUCTIONS

## GIVEN TO PATIENTS IN OFFICE AND DISPENSARY CLINIC

### Instructions for Those Having Gonorrhea

Your disease is not a simple but a serious matter and requires great care by the doctor and strict obedience to directions by you in order to restore the organs to perfect health. It is, therefore, necessary that you do with faithfulness what the doctor orders. If you do not, it is possible that the disease will produce later in your life serious conditions which may damage your health and indeed threaten your life. Gonorrhea is a contagious disease. In order to avoid infecting other persons, and in order to prevent such complications as bubo, swollen testicles, abscess and stricture, etc., the following rules should be observed:

**Do not drink** any intoxicating liquors whatever.

**Do not drink** any spicy soft drinks like ginger ale whatever.

**Do not eat** any peppery or spicy foods or pickles whatever.

**Do not drink** any tea, coffee, or cocoa whatever.

**Do not take** any violent exercise, as far as possible.

**Do not indulge** in any sexual excitement or sexual intercourse whatever, directly or indirectly, until pronounced cured by the physician, as the disease may be given to a woman even after the visible discharge has ceased. Moreover, sexual excitement always prolongs and aggravates the disease through the erections of the penis.

**You must wash and dress** the penis at least three times daily, as directed by the doctor.

**You must always burn** all soiled dressings.

**You must always** wash your hands after dressing the penis, because the discharge is blinding and may be carried to the eyes by dirty fingers.

**You must sleep alone** and be sure that no one else uses any of your toilet articles, particularly towels and wash cloths.

**Your bowels must move once every day.** If you are costive take a small dose of Rochelle salts, in hot water, before breakfast.

**You must drink** all the water possible, excepting during meals and up to six hours before going to bed.

**You must eat** chiefly milk, toast, bread, butter, and eggs, until otherwise directed by the doctor.

**You must remain** reasonably quiet.

**You must take** the medicine regularly and as directed.

**You must treat chordee** by wrapping cold wet cloths about the penis after emptying the bladder. Do not try to break it, as this will cause serious injury later.

**You must come for treatment** with as much urine in the bladder as possible, so that the doctor may examine the urine at each visit.

**You must see the doctor** three times a week in order to obtain prompt and perfect cure.

**You must take the hand injections in the following manner:**

1. Always urinate *before* taking the injection.
2. Fill the syringe, hold it tightly against the mouth of the penis, and *gently* fill the passage.
3. Hold the injection in from five to ten minutes by the watch.
4. Never use force in taking injections.
5. Never use a syringe that does not work smoothly.
6. Never use more than one syringeful at one injection, unless ordered so to do by the doctor.
7. Never lend your syringe to anyone else, and as soon as you are well destroy it.

**''Shreds'' or ''floaters'' in the urine** show that you are not yet well and are still in a condition of danger to yourself and to any woman with whom you have intercourse.

## Instructions for Those Having Syphilis

## (Lues, Pox, Blood Disease)

Syphilis is a treacherous and dangerous disease of the entire system, and requires for perfect cure, at least two, better still, three years of faithful treatment, because it is ''in the blood.'' Healing the chancre and taking medicine for a *few weeks or months* will not cure your blood of the syphilitic poison. It is, therefore, necessary that you follow the doctor's orders most carefully. If you do not, you are in danger of having the disease appear in the future in some important part of the body like the brain, spinal cord, bones, arteries, or other organs, as the liver. If you do not follow directions it is also possible that your wife and children will acquire the disease from you.

**The following directions are of particular importance during the first year** and whenever, if you neglect yourself, the symptoms break out again.

**Intoxicating liquors in all forms must not be taken,** because alcohol is a poison which, added to the poison of the syphilis, makes the syphilis much less likely of perfect cure.

**Do not smoke or chew tobacco,** because the irritation of the tobacco increases the severity and duration of the mouth sores of syphilis.

**Sour, acid, peppery and spicy foods and pickles should be avoided** for the same reason.

**Brush your teeth and wash your mouth** every night and morning. Cleanliness of the teeth and mouth decreases the severity and duration of the mouth sores of syphilis.

**Allow no one else to use your toothbrush.**

**Have a dentist treat your teeth,** if they are bad. Tell him at the first visit that you have syphilis, so that he may take precautions against catching the disease himself and giving it to other patients.

**To prevent giving the disease** to your family, friends and associates, observe the following rules strictly:

**Always sleep alone.**

**Always use your own toilet articles,** such as towels, brushes, combs, shaving brushes, razors, soaps, etc.

**Always keep only for your own use any article which has been in your mouth,** such as toothbrushes, toothpicks, pencils, pipes, cigars, cigarettes, forks, spoons, cups, etc.

**Always avoid kissing** anyone, especially children.

**Sexual intercourse must not be had** during the first year, and during any fresh outbreak after neglect of treatment, because you are then certain to give the disease to the woman.

**Always burn dressings** which have been on open sores or wounds.

**If you disobey these directions** you will certainly give the disease to innocent persons.

---

**Rubber stamp** used in office and clinic for recording findings in gonorrhea:

**URINES** I, Turbid and shreds. II, Clear.
**PROSTATE** Left lobe enlarged and nodular; right, normal in size and hard.
**VESICLES** Imbedded in perivesicular infiltration.
**URETHRA, BULB** No. 24; stricture 2 inches from meatus.
**ENDOSCOPE ANT.** Soft infiltration, going over into hard; ½ doz. crypts.
**POST.** Bleeds freely; colliculus enlarged; small polypus on upper surface.
**MICROSCOPE, SMEAR** Pus, squamous epithelium; moderate number of intracellular gonococci.
**EXPRESSED CONTENTS OF PROSTATE AND VESICLES** Moderate amount of pus; no organisms.

*Diagnosis.*—Chronic gonorrhea anteroposterior; prostatitis, perivesiculitis, and stricture.

# APPENDIX

The importance of the microscope in the diagnosis of diseases of the genitourinary tract is so great that a short account of the methods of preparing and examining specimens of pus and urine may be of use for practitioners.

For the methods of laboratory technic the author desires to acknowledge his indebtedness to Dr. T. W. Hastings, of the Cornell Laboratory of Clinical Pathology, and Dr. A. Murray, of the Long Island College Hospital and Hoagland Laboratory.

**Urethral discharges,** containing gonococci or other microorganisms, may be examined by making a thin smear with a platinum loop, on a cover-glass or slide, and submitting the smear to the following steps:

I. Dry in the air.

II. Fix by passing the glass three times through a Bunsen flame.

III. Stain with Loeffler's solution for two to three minutes.

| | |
|---|---|
| Saturated alcoholic solution of methylene blue...... | 30 c.c |
| Sol. potassium hydrate (1:10,000).................. | 100 c.c. |

IV. Wash in water.

V. Blot and dry.

VI. Mount in Canada balsam and examine with cedar oil and oil-immersion objective.

Loeffler's solution stains all the organisms blue, and, in order to differentiate the gonococci from other organisms, Gram's method must be used.

It is desirable to use this method of counterstaining not only to identify the gonococcus, but also to find other organisms which may be present in cases of mixed infection or of nonspecific urethritis.

**Gram's Method:**

I. Dry and fix.

II. Cover the preparation with the following solution and allow to stain for one minute:

CARBOL-GENTIAN-VIOLET

| | |
|---|---|
| Saturated alcoholic solution, gentian-violet............ | 10 c.c. |
| Carbolic acid water (2.5 per cent).................... | 90 c.c. |

III. Pour off excess of stain and add:

GRAM'S SOLUTION

| | |
|---|---|
| Iodine crystals | gm. 1 |
| Potassium iodide | gm. 2 |
| Distilled water | 300 c.c. |

Allow to act for one minute; then pour off.

IV. Decolorize in the following solution until no further trac of the stain can be washed out:

| | |
|---|---|
| Acetone | 100 c.c. |
| Alcohol | 300 c.c. |

V. Counterstain with carbol-fuchsin (Ziehl's sol.) diluted 1:1

VI. Wash in water.

VII. Blot and dry.

VIII. Examine, if on a slide, with cedar oil placed on the slid If on a cover-glass, mount in Canada balsam before so doing.

Gram-*positive* organisms retain the gentian stain and remai blue or bluish black.

The Gram-*negative* organisms take counterstain and are red.

**List of Gram-positive organisms remaining blue,** most commonl found in genitourinary conditions:

Tubercle bacillus.  
Staphylococcus.  
Streptococcus.  
Smegma bacillus.

**Gram-negative organisms remaining red:**

Gonococcus.  
Micrococcus catarrhalis.  
Bacillus coli.  
Bacillus mucosus capsulatus.  
Bacillus typhosus.

**Prostatic secretion** may be collected (*a*) in a test tube as it ooze from the meatus after massaging the prostate.

(*b*) It may be caught on a glass slide.

(*c*) The sediment from the expression urine may be used fo examination after it has been thoroughly centrifugated.

The following **scheme of examination** is useful in examining se cretions in a test tube or the sediment of the centrifugated urine, an may also be used in cases of cystitis or pyelitis when tuberculosi is suspected.

I. Examine fresh, to get a general idea of the number of cells

II. Stain fresh secretion by adding a drop of Loeffler's solutio to it, and examine at once, to gain an idea of the type of cells.

III. Dry, fix, and stain with Loeffler's solution, to find bacteria

IV. Dry, fix, and use Gram stain, to differentiate the types of bacteria.

V. Celloidin method may be used to identify shreds of tissue.

In order to dry, fix, and stain, the prostatic secretion or centrifugated sediment of the urine may be treated as follows:

I. Put on slide.

II. Spread with a plat loop, drying carefully over flame. Do not burn.

III. Fix by passing three times through the flame. Thorough fixing is necessary; otherwise, the secretion washes off after staining.

IV. Stain with Loeffler's solution one to two minutes.

V. Wash.

VI. Blot with filter-paper and dry.

VII. Mount in Canada balsam and cover-glass, or put a drop of cedar oil on slide and examine without a cover-glass.

**Tubercle Bacilli.**—In cases of suspected tuberculosis, cystitis, or pyelitis, the bacilli may, in most cases, be found by using the following methods:

If a very small amount of sediment is present after centrifugation, the celloidin method may be used, but the following plan is applicable to most cases:

**Hansell's Method:**

I. Centrifugate the urine ten or fifteen minutes, and use all the sediment to make a thick layer on the slide.

II. Dry by heat (slowly).

III. Fix in flame.

IV. Carbol-fuchsin stain, steam for one to two minutes.

| | | |
|---|---|---|
| ℞ | Sat. alcoholic sol. basic fuchsin...... | 10 c.c. |
| | Carbolic acid (5 per cent).......... | 100 c.c. |

V. Wash.

VI. Decolorize. Hansell's solution.

| | |
|---|---|
| Alcohol (95 per cent)............. | 97 parts |
| Hydrochloric acid, c. p. .......... | 3 parts |

Sputum decolorizes in five to ten minutes.

Urine requires half an hour.

VII. Wash.

VIII. Blot.

IX. Counterstain for one to two minutes with:

| | |
|---|---|
| Methyl blue, aqueous sol. (1 per cent), | |
| Alcohol (95 per cent).......... | equal parts |

X. Wash, blot, dry, and examine.

Tubercle bacilli are slim, curved at one end, beaded, and in clumps of two or three, and take a red stain.

If there is any doubt as to the identity of the tubercle bacillus, use steps I, II, III, IV.

V. Decolorize 25 per cent nitric or sulphuric acid three to five minutes; if red color continues, use acid until washes clear with water.

VI. Wash, and if marked color returns wash in acid again.

VII. Place in alcohol 95 per cent eighteen to twenty-four hours.

VIII. Wash, blot, and counterstain.

To differentiate between the tubercle bacillus and the smegma bacillus **Pappenheim's method** may be used.

Use steps I, II, III, and IV as above.

V. Pour off stain without washing and cover with the following mixture:

| | |
|---|---|
| Corallin (rosolic acid) | 1 gm. |
| Absolute alcohol | 100 c.c. |
| Methylene blue added to saturation. | |
| Add glycerin (last) | 20 c.c. |

This mixture is poured on the smear and drained off slowly four or five times and finally the preparation is washed in water. The tubercle bacilli remains bright red while the smegma bacilli are decolorized.

**Kanthac's method** is particularly useful in finding the tubercle bacilli when the urine contains large quantities of pus. After centrifugating the urine or allowing it to

I. Stand in a conical glass, add to the sediment five or ten times its bulk of 5 per cent carbolic acid, depending upon amount of pus.

II. Shake hard until particles are broken up.

III. Recentrifugate, or let it stand in a conical glass for twelve hours.

IV. Examine the last few drops at the bottom of the cone.

V. Stain the drops by Hansell's method.

**The method of Inoscopy** may be used if much blood is present; the clot is digested with artificial gastric juice, freeing the bacilli and allowing them to sink to the bottom.

I. Centrifugate the fibrin.

II. Add to the shreds 10 to 30 c.c. of Jousset's fluid.

| | | |
|---|---|---|
| ℞ | Pepsinæ | 2 gm. |
| | Sodii fluoridi | 3 gm. |
| | Acidi hydrochlorici, | |
| | Glycerini ãã | 10 c.c. |
| | Aquæ | 1000 c.c. |

This solution keeps indefinitely.

III. Stand in warm box or over steam radiator over night, to digest fibrin.

IV. Centrifugate and examine last drop for tubercle bacilli.

V. Stain by Hansell's method or any other.

**The celloidin method** is useful in examining urine containing shreds of tissue from a suspected tumor of the bladder, to determine if it is malignant or benign. It is also useful in examining the urine when tuberculosis of the bladder or kidney is thought to be present, and when but very little sediment can be obtained.

I. Slides fixed half-hour at 36° C.

II. Flood with thin celloidin (Collodion thinned down to consistency of water, with alcohol and ether, equal parts).

III. Wash for a few seconds with cold tap-water.

IV. Blot and dry.

V. Alcohol, 95 per cent, five to ten minutes.

VI. Wash and dry.

VII. Stain with Delafield's hematoxylin, five to ten minutes.

VIII. Wash, stain with 1 per cent aqueous solution of eosin, five to twenty seconds.

IX. Wash again.

X. Decolorize and dehydrate with 95 per cent alcohol, one-half to two minutes.

XI. Absolute alcohol, one minute.

XII. Xylol, one minute.

XIII. Blot and dry.

XIV. Mount in balsam.

**Spermatozoa.**—In cases of sterility it is necessary to examine the semen to determine the presence or absence of spermatozoa. After massaging the seminal vesicles, spermatozoa, when present, can usually be found in the expression urine, but for a complete examination the patient should be directed to have sexual intercourse, using a condom, and the ejaculated semen contained in the condom should be examined as soon as possible.

The spermatozoa can be easily found when present. Staining brings them out more prominently. The method is as follows:

I. Make smear, ten minutes in absolute methyl alcohol.

II. Fix for one-half to one hour in 27 to 30 per cent alcohol.

III. Stain three to ten minutes in ½ per cent solution of eosin in glycerin.

IV. Wash in water.

V. Examine.

The heads stain pink and the tails faint pink.

**Spirocheta Pallida.**—To examine for the organism of syphil[illegible] smears should be made with a platinum loop on cover-slips, from t[illegible] serum.

Serum may be obtained from the *chancre* by squeezing it or cutting through its border with a sharp Hagedorn needle or a sm[illegible]al lancet.

From *secondary* eruptions, the serum is obtained by scarifying or scraping their surfaces.

The serum is obtained from *mucous patches* by rubbing off the surface with gauze or alcohol.

The smear should be allowed to dry in the air and stained by one of the following methods:

I. Schereschewsky's method.
II. Giemsa method.
III. Goldhorn's method.
IV. Nocht's method.
V. Schaudinn's method, with Loeffler flagella stain.

**Schereschewsky's Method—**

I. A drop of the serum from the chancre is placed on a slide and a smear made in the same manner as when making a blood smear.

II. Allow to dry in air.

III. Fix carefully in flame.

IV. In a clean test tube previously rinsed with hot alcohol and then with distilled water place 10 c.c. of a 0.05 per cent watery glycerin solution and add 13 drops of Giemsa's solution (Grübler) and mix thoroughly.

V. Heat to boiling and, if no precipitate appears, pour on the slides, allowing it to remain for three minutes.

VI. Pour off stain, rinse preparation in distilled water.

VII. Apply stain again (a third time if necessary) as above.

When sufficiently stained the fiber appears a deep pink, with a slight metallic luster when dry.

VIII. Rinse in water.

IX. Dry without heating.

X. Add a drop of cedar oil.

XI. Examine with a $\frac{1}{12}$ oil-immersion lens.

The *Spirocheta pallida* appears as an intense pink.

The *Spirocheta refringens* stains equally well, but may be distinguished by its greater thickness and by its wavy convolutions.

**Giemsa method,** furnished by the courtesy of Dr. Roscher, of Lesser's Clinic, Berlin:

I. Dry in air.

II. Fix ten minutes in absolute alcohol.

III. Stain with Giemsa one and one-half hours by laying the cover-glass in a watch-glass, with the stain underneath.

IV. Wash in water.

V. Dry, mount in balsam, and examine.

The stain consists of:

| | |
|---|---|
| Giemsa II, eosin | 3.0 |
| Azur II | 0.8 |

Mix and rub fine, and filter through gauze.

Dissolve in glycerin, *pure,* 250 grams, for one hour, at a temperature of 60° C.

After cooling add methyl alcohol (Kahlbaum I), 250 grams. Of this solution add 14 drops to 10 c.c. of water for use.

**Goldhorn's Method:**

I. Use smear which is well dried, but not by heat.

II. Flood with stain for three to five seconds.

III. Pour excess of stain back into bottle: can be used again.

IV. Place slide in glass of tap-water, three to five seconds.

V. Wash by shaking in water.

VI. Drain off excess of water.

VII. Dry in air; do not blot or heat.

After staining, the slide should appear blue; if not, has been in water too long.

The *Spirocheta pallida* appears reddish purple, while the *S. refringens* is bluer in color.

Goldhorn's stain can be bought ready for use from E. Leitz & Company.

**Nocht's Method:**

I. Fix smears in methyl alcohol ten minutes (or absolute alcohol twenty to thirty minutes).

II. Wash and blot.

III. Stain with mixture of the three following solutions:

*(a)* 1 per cent aqueous solution of eosin (water-soluble yellow).

(*b*) 1 bottle Unna's or Goldhorn's polychrome blue.

(*c*) 1 bottle aqueous methylene blue, Ehrlich's rectified.

These are for sale, put up in methyl alcohol, by E. Leitz.

They should be mixed in the following proportions:

10 c.c. of distilled water.
2 to 3 drops of eosin solution.
5 drops of polychrome methyl blue.
2 drops of 1 per cent aqueous methyl blue.

They should be mixed in a flat Petri dish till a fine black precipitation occurs. Make fresh before using.

IV. Place fixed slide (blood side down) in watch-glass, and leave all night to stain (twelve to eighteen hours).

V. Wash.

VI. Mount in balsam.

Examine with a 3 or 4 eyepiece and $\frac{1}{12}$ oil-immersion.

The spirocheta appears red or plum-colored.

**Schaudinn's Method with Loeffler Flagella Stain.**—This method is particularly valuable in studying the structure, bringing out the flagella.

I. Fix dried smear by holding slide over a solution of osmic acid 2 per cent aqueous solution. The solution should be kept in a wide-mouthed bottle, capacity of 150 c.c., and the slide dipped in the bottle, but not immersed in the fluid: one to three seconds.

II. Flood fixed smear with following solution, two minutes:

| | |
|---|---|
| Tannic acid solution (20 per cent)... | 100 c.c. |
| Cold saturated solution ferrous sulphate (1 gram in 50 c.c. of water) | 50 c.c. |
| Sat. alcoholic solution basic fuchsin.. | 10 c.c. |

Allow the solution to stand twenty-four to forty-eight hours; open to the air to ripen.

After standing, add 6 to 8 drops of 25 per cent sol. sodium hydroxide.

III. Wash thoroughly in water.

IV. Wash off excess of water and stain with carbol-gentian-violet two to three minutes.

| | |
|---|---|
| Sat. alcoholic solution gentian-violet.. | 10 c.c. |
| Carbolic acid (5 per cent).......... | 100 c.c. |

V. Wash in water.

VI. Dry in air.

VII. Mount in balsam.

*Spirocheta pallida* takes a deep-red stain, and many show flagella at one or both ends.

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